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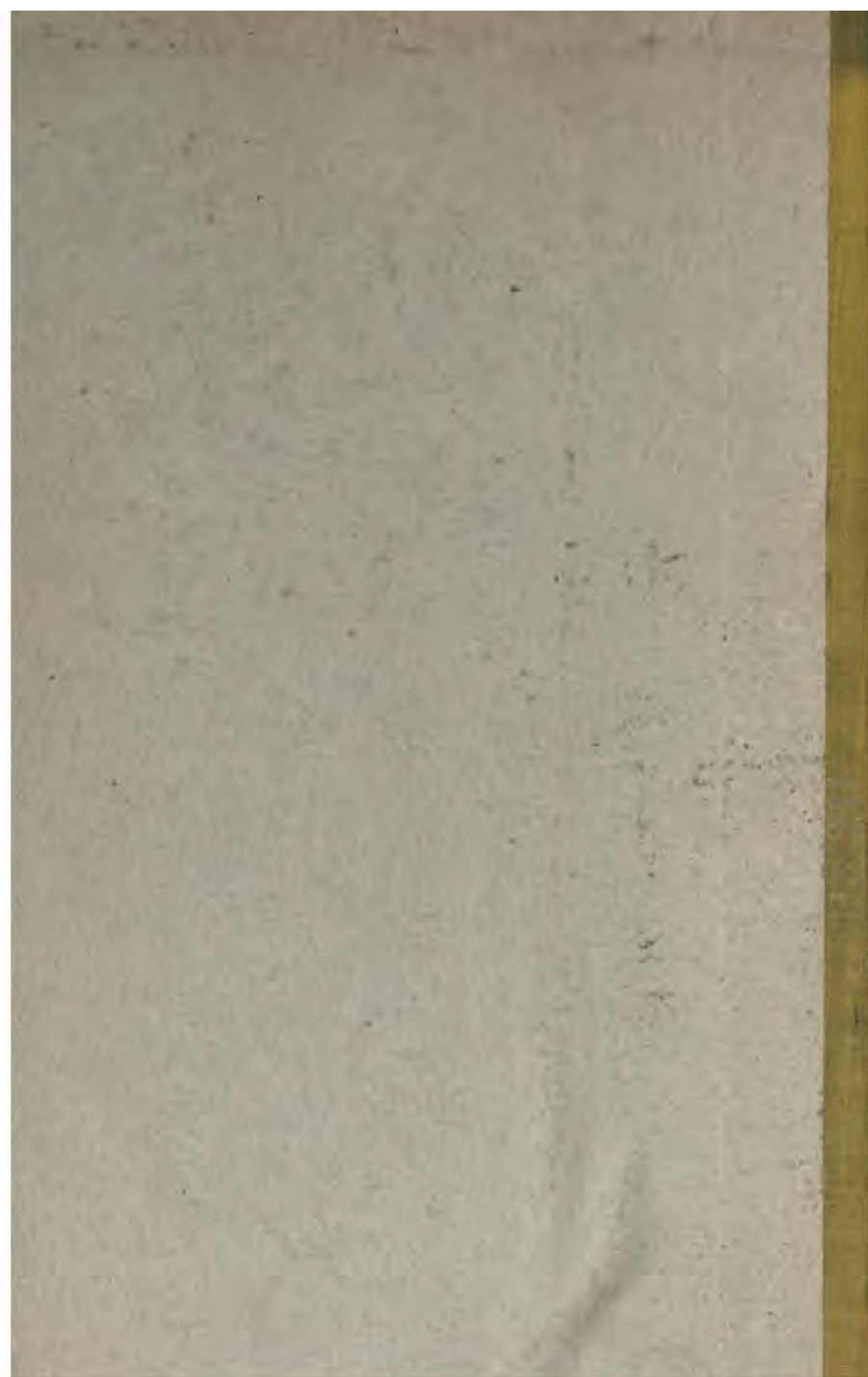
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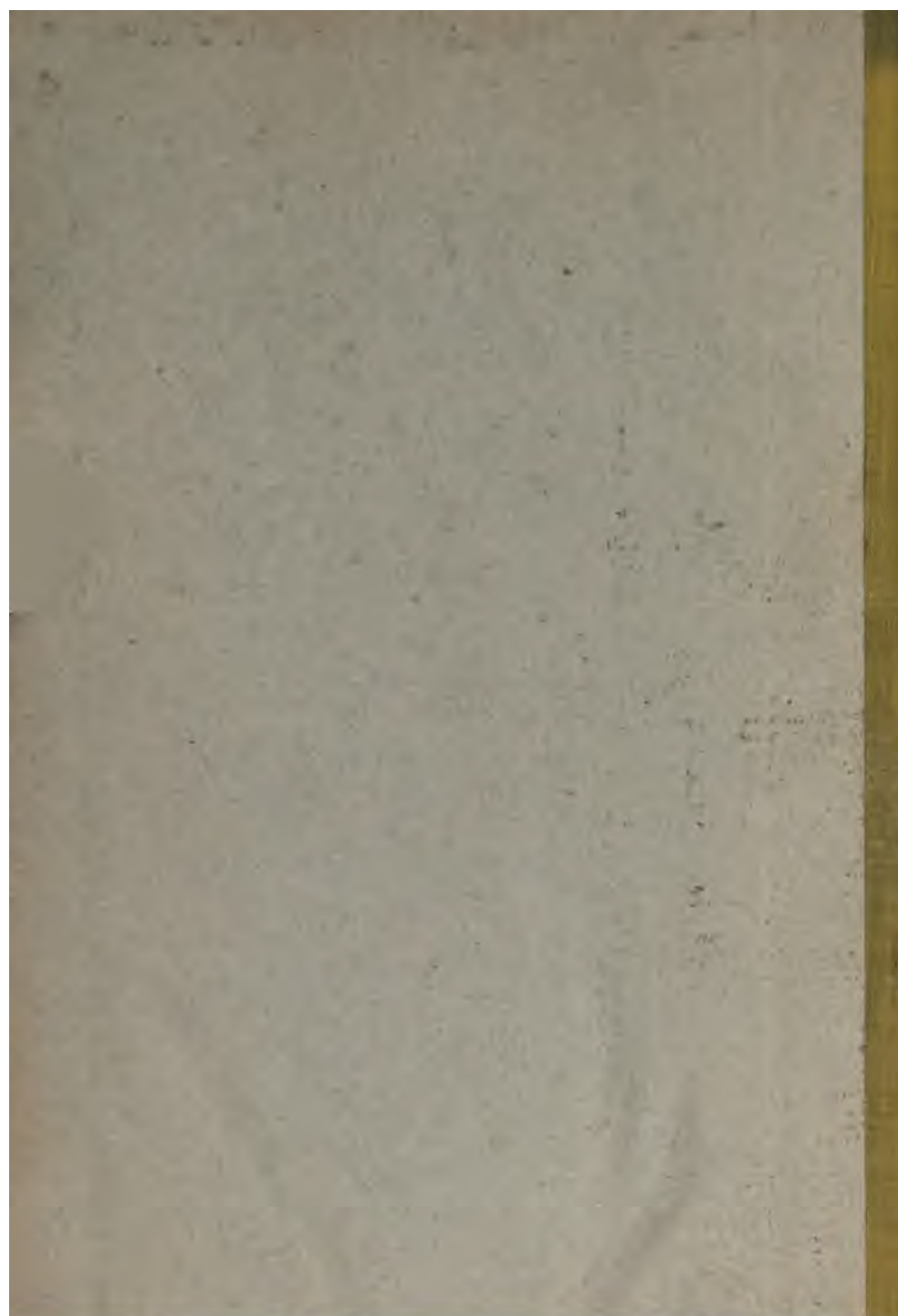
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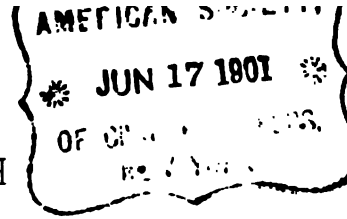
Lowell
Watson

ATLANTA





TWENTY-EIGHTH



ANNUAL REPORT

OF THE

LOWELL WATER BOARD

TO THE

City Council of the City of Lowell, Mass.,

AND THE

REPORTS OF THE SUPERINTENDENT OF WATER WORKS AND OF
THE CITY ENGINEER TO THE WATER BOARD FOR 1900.



LOWELL, MASS.:
F. A. M. TOBIN'S PRINTERY.
1901.

U. S. ARCH. 19 JULY 1902

AM. SOC. CIV. ENG.

ORD COLL'N



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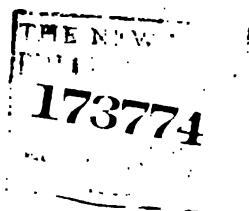


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1901.

RECEIVED JULY 19 1902

AM. SOC. CIV. ENG.

FIELD COLL'N



WATER DEPARTMENT, 1900.

WATER BOARD.

FRANK L. WEAVER, President.

Term expires second Monday in March, 1904.

MICHAEL J. DOWD,

Term expires second Monday in March, 1901.

AUGUST FEIS,

Term expires second Monday in March, 1902.

HERBERT C. TAFT.

Term expires second Monday in March, 1903.

J. W. CRAWFORD, Secretary and Clerk.

ROBERT J. THOMAS, Superintendent.

GEORGE BOWERS, City Engineer.

D. B. H. BARTLETT, Engineer.

WILLIAM JOYCE, Asst. Foreman.

THOMAS McLOUGHLIN, Engineer.

JOHN E. LOWNY, Meters.

JOHN B. HENRY, Keeper Reservoir.

ALBERT HALLOWELL, Foreman Shop.

THOMAS F. DOYLE, Foreman.

A. F. COGER, Hydrants and Gates.

THOMAS ROGERS, Services.

OFFICE.

GEO. E. WORTHEN, Service Clerk.

GERTRUDE W. BYAM, Bookkeeper.

JULIA A. RAFTER, Asst. Bookkeeper.

INSPECTORS.

ROBERT GARDNER, JR.

MICHAEL H. MCCUE.

FREDERICK A. BABON.

GEORGE F. TILTON.

WALTER P. WILEY.

REPORT OF THE WATER BOARD.

OFFICE OF THE WATER BOARD,

CITY HALL,

LOWELL, MASS., Jan. 1st, 1901.

*To His Honor the Mayor and the City Council of
the City of Lowell.*

Herewith is presented the twenty-eighth annual report of the Water Board, for the year ending December 31, 1900.

The membership of the Board remained the same as the previous year, Mr. Weaver being re-elected for another term by the City Council, and also re-elected President of the Water Board for the fourth time.

Dr. Harrington's report upon his analysis of the city water was received in February, and, as was expected, confirmed the findings of the State Board of Health. Two hundred samples of water from all sections of the city and under various conditions were sent him and his report is exhaustive and complete. In it he says: "Reverting to the questions involved in the investigation, the first to be considered is whether or not Lowell water exerts an unusual corrosive action on lead pipe. The

subject of the corrosive action of water on lead pipe has nowhere and by nobody been more extensively or more thoroughly studied than in Massachusetts by the State Board of Health. From their report it appears that in four places in the State, viz.: Lowell, Milford, Kingston and Fairhaven, a large amount of lead poisoning has been reported and that interviews with physicians in the towns and cities where series of samples have been taken fail to show a prevalence of lead poisoning in any except the four places mentioned above."

The following table compiled from the published reports shows first the amounts of lead in the samples from the four places mentioned, and next in those from other places where lead poisoning is not prevalent. In the latter group are included only those supplies which exert a corrosive action equal or superior to that of the Boulevard water:

AVERAGES.

Places.	Standing.	Ordinary Use.
Lowell .....	.1933	.1899
Milford.....	.1991	.1258
Kingston.. . . .	.1962	.0944
Fairhaven .....	.2461	.0959
Stoughton.....	.2178	.0774
Chicopee (Abbe). . . . .	.3921	.0788
Chicopee (Cooley).....	.1037	.0409
Boston . . . . .	.1778	.0099
North Easton.....	.1667	.0414
New Bedford.....	.1466	.0177
Ashburnham.....	.1210	.0307

South Hadley . . . . .	.1194	.0885
Lawrence.	1094	.0276
Rockland. . . . .	.1057	.0288
Malden . . . . .	.1056	.0309
Palmer. . . . .	.0829	.0511

"In comparison it appears that the Boulevard water on standing in lead pipes takes up less lead than the waters of the three other places, Milford, Kingston and Fairhaven where poisoning is common and less also than those of Stoughton, Chicopee, Boston, North Easton, New Bedford, Ashburnham, South Hadley, Lawrence, Rockland and Malden in which places lead poisoning is not prevalent. It also shows that the Cook water is more corrosive than that of any of the places where lead poisoning is common."

SUMMARY OF AVERAGE RESULTS.

Boulevard.

Standing.	445 samples	0.1029
Running	16 "	0.0179
Ordinary use.	18 "	0.0440

Cook.

Standing	35 "	0.4273
Running	39 "	0.0747
Ordinary use.	13 "	0.2689

"Coming now to the question: 'Does Lowell water contain an amount of lead dangerous to health?' In attempting to set up a standard in such matters we must be guided by experience, not by arbitrary rules. Fortu-

nately, as we have seen, we have facts before us of the greatest value. We know that in certain towns large numbers of cases of lead poisoning have occurred in consequence of drinking water having a marked corrosive action on lead pipe. We know furthermore, that in certain other towns with water supplies that exert a less marked but yet considerable action on lead, no trouble is experienced."

"The Cook water contains a dangerous amount of lead, even under conditions of ordinary use."

"All things considered, I feel that the best solution of the difficulty is the abandonment of the Cook and Hydraulic wells. In order to make up for the deficiency in supply which this course would entail, I recommend the extension of the Boulevard plant, if it be possible, rather than the installation of another elsewhere, and also in preference to undertaking sand filtration of the water of the Merrimack River. The Boulevard supply is of excellent quality and has no more action on lead than the Merrimack water at Lawrence, where, so far as is known, no trouble on the score of lead poisoning exists. I further recommend that though for ordinary purposes the Cook supply be abandoned, the plant be maintained for use in cases of emergency. Should, for example, an accident occur at the Boulevard plant, the Cook supply could be brought into temporary use pending repairs: for it is not the occasional but the continuous use of water containing lead that produces untoward results."

The driving of test wells in the valley of Beaver Brook near the New Hampshire line indicated conditions favorable for obtaining a large quantity of water from the

ground at this place, but the report of the analysis of the water by the State Board of Health state that, "The tests as a whole are somewhat unfavorable with respect to the quantity of carbonic acid present and indicate that the water might have serious action upon lead pipes. Further and more thorough tests might show a considerably different result." But it being essential that additional water be procured with as little delay as possible operations were transferred to the Boulevard and, on January 24th, a committee reported the estimated cost of fifty-four additional wells at the Boulevard on land owned by the city would be \$6,405.00 and the Superintendent was directed to proceed at once to procure the material and go on with the work; and we were thus able in May to connect these additional wells to the pumps at Station No. 4 and increase our available supply at this Station by two million gallons. But as the capacity of the pumps at this Station are but slightly in excess of six million gallons, it was necessary to install another engine to get the benefit of the additional quantity of water. Contracts were accordingly made with the Knowles Pump Works for a new 3,000,000 gallon pump, with Scannell & Wholey, for two new boilers and with P. Conlon for enlarging the Station for these improvements. The work was all finished in due season, but owing to delay in procuring some of the fittings necessary, we have been unable to start pumping.

It then became necessary to cross the Boulevard if more wells were to be put down, and to purchase land for that purpose, and the owner of the "Cushing Farm," so called, was communicated with and also it was determined to ask the City Council to authorize a loan of

\$75,000.00 for the purpose of additional wells. The "Cushing Farm" was purchased after thorough tests had been made on the land to indicate a sufficient quantity of water and which the State Board of Health pronounced satisfactory in quality. But to preserve the water from possible contamination it was deemed advisable to buy all the land west of the terminus of Pawtucket Boulevard as far as the Cushing land adjoining Tyngsboro Boulevard and extending back about 750 feet. Part of this land had been laid out in streets and divided into lots and was owned by many different people widely separated, so we employed Mr. H. W. J. Howe, as agent, to purchase the land, limiting him to a price of two cents per foot, the land being assessed at one cent per foot, and Mr. Howe did his work so expeditiously and thoroughly that all the land has been purchased without recourse to legal proceedings.

Following is a list of the lots purchased, amounting to about fifty-nine acres:—

George W. Cushing.....	35 1-2 acres
W. T. S. Bartlett.....	4,114 feet
S. K. Chase.....	20,076 "
Mary L. Clement.....	10,192 "
William H. Dane.....	5,809 "
Alfred Desjardins.....	17,756 "
Willis E. Dodge.....	8,929 "
Sarah A. Hallett	5,000 "
James W. Halstead.....	5,000 "
Benjamin Hodgman.....	5,640 "
Margaret Marley.	14,740 "
Thomas McPhail.....	6,408 "

John O'Rourke.....	26,544	feet
Electa R. Spray.....	19,854	"
Angie C. Brewer.....	14,000	"
Harley J. Currier.....	9,823	"
Sarah Curry.....	5,821	"
Peter A. Fay.....	5,000	"
John Fitzsimmons.....	5,132	"
Vira M. Floyd.....	14,010	"
D. F. Gateley.....	10,771	"
Leroy E. Howlitt.....	4,623	"
William D. Large.....	5,758	"
Adeline Marchand.....	5,077	"
James T. O'Hearn.....	8,737	"
Amasa Pratt.....	5,201	"
Elizabeth L. Priestly.....	5,000	"
William Smith.....	7,395	"
George F. Stiles.....	11,010	"
Ella F. Taylor.....	10,528	"
Augustus Work.....	10,270	"
George W. Bagley.....	11,507	"
Hannah J. Belisle.....	15,380	"
Marie Bissonnette.....	5,000	"
David Chase.....	14,713	"
Philip Cinqmars.....	10,484	"
Samuel Cinqmars.....	30,532	"
Anna K. Coburn.....	10,095	"
Carrie E. Farrar.....	5,000	"
Georgianna Fontaine.....	5,000	"
Edward S. Howe.....	354,763	"
Annette McKissock.....	5,000	"
Julia Prevost.....	10,000	"

E. H. Choquette.....	9,598	"
J. A. Choquette.....	4,520	"
Mary J. Collins	7,860	"
Edmund Gaudette....	16,349	"
T. J. Underwood.....	219,795	"
Mary Quinn.....	4,792	"

Somewhat more land was purchased than the original estimate provided for, but it was deemed advisable to do so to prevent possible contamination in the future. The work on the Well plant is progressing and it is expected that by summer sufficient water will be available at the Boulevard to supply the needs of the whole city. The loan of \$75,000.00 became available in August and there has been expended \$62,403.24, leaving a balance of \$12,596.76, December 31st.

The finances of the Water Works proper show a gratifying result of efforts toward economy of management, and although the expenditures of \$202,634.80 is slightly in excess of last year, it must be borne in mind that \$6,000.00 of that amount was for the driven wells; also the price of coal was \$1.12 per ton more than the previous year, viz., \$4.90 against \$3.78 1/2. When bids for coal were called for in June, the lowest price named was \$4.90 per ton for all delivered previous to September, 15th; later deliveries to be \$5.15 and \$5.40 per ton. As the capacity of our bins is not sufficient to take 5,000 tons, the contract was made to cover the time until January 1st, 1901, at the lowest price. Four thousand six hundred tons were put in at this price, an excess in price over last year of over \$5,000.00; about 3500 tons remain on hand January 1st, 1901.

The balance at the year increased	\$7,515 08
Charges for water increased.	9,894 70
Receipts increased	7,726 84

Criticism is made because the Water Department should carry over so apparently large a balance each year, but it should be borne in mind that the bills are all collected in December and not much comes in until May when the bills for the ensuing year are sent out; in the meantime expenses continue, including \$20,000.00 for interest on bonds and this balance is reduced to \$7,000.00 or \$8,000.00 and has been reduced to as low as \$2,500.00. Consequently, this balance precludes the necessity of borrowing money in anticipation of water rates as has to be done for the other city uses in anticipation of taxes.

The members of the Board are steadfast in their belief in the necessity of the installing of water meters to stop the waste of water.

It costs too much for the city to furnish water for it to be run to waste. When the city procured its supply from the river, the question of a waste of water was not of so much importance except in the increased cost of the unnecessary pumpage. With the introduction of driven wells yielding a limited supply, the necessity of guarding against waste becomes imperative. About 51 1-2 per cent. of the taps are metered and these taps use about one fourth of the total water consumed. It would seem that if the remaining 48 1-2 per cent. of the taps were metered there would be great saving of the water. By so doing, the present supply will doubtless be sufficient for a great many years. But if the present extravagant waste of water

is permitted the city will be obliged to procure a new supply at great expense.

The Board has therefore determined to make a start in this direction. They have caused to be prepared a list of places where they believe that there is a great waste of water and will put meters on them at once, and hope that if this policy is continued, every service in the city will be metered and our present supply will be ample without stinting the proper use of water in any manner.

FRANK L. WEAVER,
AUGUST FELS,
MICHAEL J. DOWD,
HERBERT C. TAFT.

LOWELL WATER WORKS OFFICE,

January 1, 1901.

TO THE LOWELL WATER BOARD:

Gentlemen,—Herewith I submit figures detailing the finances of the Lowell Water Works for the year ending December 31st, 1900.

J. W. CRAWFORD,

Clerk.

TABLE I. FINANCIAL STATEMENT—LOWELL WATER WORKS, 1903.

CHARGES BY ACCOUNTS.										REVENUES BY ACCOUNTS.		
	Water.				Other Uses, Water.	Total Charges 1903.	Total Charges 1902.	Receipts.	Disbursements.	Balance forwarded.	Total.	
	Date.	Meters.	Totals.									
December	1	1	1	1	1	\$21,767.42	\$24,262.22	\$27,070.70	\$2,003.04	\$24,067.66	\$1,028.07	
January	1	1	1	1	1	820.00	8,172.40	822.00	8.78	813.22	1	
February	1	1	1	1	1	1	108.00	1	1	1	1	
March	1	1	1	1	1	1	102,700.00	87,200.00	9,000.00	2,023.00	100.15	
April	1	1	1	1	1	2,824.00	3,712.00	2,000.00	111.00	60.70	126.02	
May	1	1	1	1	1	1,728.00	2,007.00	2,704.00	120.00	42.07	120.17	
June	1	1	1	1	1	1,100.00	40,000.00	44,100.00	4,700.00	117.00	320.03	
July	1	1	1	1	1	1,700.00	2,500.00	1,826.70	27.00	13.50	140.77	
August	1	1	1	1	1	1,000.70	2,404.70	1,700.00	20.00	27.00	102.00	
September	1	1	1	1	1	922.00	32,200.70	25,824.00	9,000.00	107.00	418.00	
October	1	1	1	1	1	1,004.00	1,000.10	1,121.00	15.00	8.00	551.12	
November	1	1	1	1	1	900.00	770.00	204.00	02	66.74	607.00	
Year						87,100.07	97,720.00	6,037.00	62.00	1	30,140.02	
Total						\$200,100.00	\$279,200.00	\$210,140.04	\$21,404.16	\$24,878.00	\$34,000.00	

TABLE II. FINANCIAL STATEMENT—LOWELL WATER WORKS, 1900.

OUTGO.

	Pay Roll and Salaries.	Water Works Supplies.	Interest and Principal.	Refunds and Va- cancies.	General Expense Account.	Stable Depart- ment.	FUEL.	Totals.	
								1900.	1899.
January . .	\$4,306 50	\$1,497 07	\$ 600 00	\$ 40 23	\$ 683 66	\$ 179 96	\$3,102 82	\$10,380 24	\$ 5,700 32
February . .	4,070 91	2,014 49	7,917 50	8 00	287 43	333 84	312 34	14,914 56	12,908 85
March . . .	4,794 51	999 38	240 00	88 94	195 72	27 84	204 04	6,550 43	5,955 53
April . . .	5,205 96	4,968 49	100 00	30 18	2,245 36	267 17	1,287 45	14,082 61	10,715 34
May	5,373 22	2,645 51	18,976 00	1,033 77	477 62	93 81	5,106 93	33,708 86	45,233 15
June	6,543 40	1,438 86	1,680 00	85 28	185 60	89 12	2,139 84	12,092 10	13,025 49
July	4,754 31	797 70	10,100 00	94 80	175 21	486 32	-	16,418 34	22,462 59
August . . .	4,585 36	1,664 49	1,757 50	153 35	159 40	41 33	7,242 00	15,603 43	13,305 00
September . .	5,470 37	1,194 50	120 00	55 78	214 10	46 99	1,743 97	8,845 71	13,164 91
October . . .	4,669 89	1,376 75	5,960 00	94 84	64 11	76 47	5,183 47	17,425 53	8,123 29
November . .	4,730 22	1,062 29	20,816 00	12 90	333 73	60 79	5,247 48	41,273 41	34,940 52
December . .	4,999 77	1,453 36	2,160 00	116 26	274 94	116 03	2,217 25	11,341 59	16,468 79
Totals . . .	\$59,514 42	\$31,100 88	\$79,407 00	\$1,764 32	\$5,260 88	\$1,819 71	\$33,767 69	\$292,634 80	\$202,012 78

TABLE III. FINANCIAL STATEMENT—LOWELL WATER WORKS, 1900.
Subdivision of "Other Than Water Charges" From Table 1.

	Meters Sold.	Expense Setting Meters.	Meter Repairs.	New Services.	Changed Services.	Labor and Material.	Building Charges.	Shut-off Pipes.	Sewer Plumbing.	Interest.	Totals.
											1900. 1901.
January . . .	\$ 286 00	\$ 26 10	\$ 60 13	\$ 50 00	\$ 5 45	\$ 83 00	\$37 50	-	-	-	\$ 130 55 \$3,065 00
February . . .	-	-	-	-	-	-	-	-	-	-	516 19
March . . .	-	-	-	-	-	-	-	-	-	-	-
April . . .	1,230 70	163 44	153 86	134 00	30 30	535 86	30 84	\$10 00	\$ 4 00	-	2,360 00 1,712 84
May . . .	1,151 00	141 61	20 20	92 48	6 06	261 00	3 43	13 00	12 00	-	1,726 04 1,811 00
June . . .	597 00	66 73	54 30	160 85	236 80	18 20	12 12	3 00	-	-	1,100 07 2,270 10
July . . .	500 00	77 02	95 23	61 30	18 45	632 20	43 08	90 00	-	-	1,450 07 1,961 52
August . . .	560 00	77 64	34 60	150 44	26 35	627 66	10 14	6 00	4 00	-	1,605 73 1,917 00
September . . .	193 00	27 64	47 11	111 55	40 25	476 94	14 34	6 00	4 00	-	929 43 1,309 77
October . . .	373 00	50 72	68 44	68 68	14 05	567 30	22 14	-	-	\$375 74	1,531 30 1,453 47
November . . .	250 00	26 07	35 80	105 84	6 06	440 54	7 50	-	6 00	-	986 04 686 00
December . . .	164 00	21 60	30 48	144 60	18 55	6,422 07	30 24	6 00	3 00	-	6,465 53 741 84
Totals . . .	\$5,253 70	\$700 16	\$623 46	\$1,176 78	\$482 97	\$10,134 27	\$312 22	\$66 00	\$38 00	\$375 74	\$14,065 31 \$14,065 10

TABLE IV. FINANCIAL STATEMENT—LOWELL WATER WORKS, 1900.
Subdivision of "Pay Roll and Salaries" From Table No. 2.

Salary and Pay Roll	Office and Inspectors' Salaries	Meter Work	Extension and Construction	Knitting	Pumping Stations.			Maintenance.	Relief Services.	New Services.	Re-charged Laundry Persons.	Totals.	
					Station 1.	Station 2.	Station 3.	Station 4.				1900.	1900.
January	\$183.33	\$141.91	\$187.36	\$202.00	\$220.24	\$109.00	\$435.24	\$141.80	\$300.80	\$1,200.40	\$ 7.25	\$ 30.25	\$4,300.50
February	183.34	000.72	144.00	101.20	114.75	075.30	434.30	07.00	301.75	1,240.04	-	-	4,070.01
March	183.33	830.41	218.03	200.00	84.00	000.15	045.82	78.70	408.00	1,404.42	-	-	4,704.61
April	183.33	007.40	107.00	1,370.00	000.00	013.22	400.11	-	307.42	1,200.70	37.65	04.87	5,372.05
May	183.34	007.40	215.00	1,300.00	110.00	001.22	441.30	-	303.00	1,378.87	46.70	00.63	5,126.53
June	183.33	830.35	252.00	1,300.00	110.00	001.22	441.30	-	407.04	2,220.03	31.41	100.00	5,300.00
July	183.33	007.40	201.00	452.82	83.25	015.00	440.30	-	305.12	1,053.04	20.04	05.00	6,000.76
August	183.34	007.40	213.75	300.00	117.00	000.00	431.00	2.25	300.73	1,301.07	54.87	74.13	6,007.15
September	183.33	830.35	222.45	303.00	130.75	700.15	047.47	-	404.30	1,001.40	24.00	124.70	5,818.31
October	183.33	007.40	204.00	187.00	120.75	501.72	454.01	10.00	305.30	1,640.16	30.25	70.00	4,743.30
November	183.34	007.40	215.75	742.00	-	400.07	407.30	-	375.23	1,205.70	20.00	170.53	4,907.01
December	183.33	878.44	167.00	404.00	112.63	004.35	511.00	-	400.01	1,204.00	-	131.11	5,407.17
Totals	\$8,200.00	\$8,085.35	\$2,850.00	\$6,043.17	\$1,201.87	\$7,306.00	\$5,700.12	\$300.80	\$4,804.11	\$17,743.40	\$201.14	\$1,034.12	\$10,000.00

TABLE V.

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1900.

SUBDIVISION "WATER WORKS SUPPLIES" FROM TABLE 2.

Pumping Station No. 1, Supplies.....	\$ 1,515 05
Pumping Station No. 2, Supplies.....	808 73
Pumping Station No. 3, Supplies.....	8 24
Pumping Station No. 4, Supplies... ..	287 74
Iron pipe and specials.....	757 52
Hydrants and gates.....	1,088 14
Service pipe.....	2,287 12
Meters	5,081 64
Sidewalk boxes.	691 50
Machinery and tools	504 70
Brass castings.....	489 36
Reservoir	124 75
New wells.	5,092 90
Pig lead.....	94 73
Miscellaneous.....	2,268 76
	<hr/>
	\$21,100 88

TABLE VI. FINANCIAL STATEMENT—LOWELL WATER WORKS, 1900.

Detail of "Principal and Interest" From Table No. 2.

	Amount of Debt Jan. 1, 1900.	Rate.	Interest Paid 1900.	Principal Paid 1900.	Amount of Debt Jan. 1, 1901.
WATER LOAN BONDS:	\$1,000,000 00	4	.....	.....	\$1,000,000 00
Coupon No. 16, Nov. 1, 1898.....	.....	.....	\$ 200 00	.....	.....
Coupon No. 17, May 1, 1899.....	.....	.....	300 00	.....	.....
Coupon No. 18, Nov 1, 1899.....	.....	.....	680 00	.....	.....
Coupon No. 19, May 1, 1900.....	.....	.....	19,960 00	.....	.....
Coupon No. 20, Nov. 1, 1900.....	.....	.....	19,220 00	.....	.....
HIGH SERVICE LOAN, BONDS:	75,000 00	4	.....	.....	75,000 00
Coupon No. 37, May, 1890.....	.....	.....	1,500 00	.....	.....
Coupon No. 38, Nov. 1890.....	.....	.....	1,500 00	.....	.....
NOTES:	.....	.....	.....	.....	.....
Lowell Institution for Savings.....	12,000 00	4	360 00	\$ 6,000 00	6,000 00
Lowell Institution for Savings.....	25,000 00	3 1-2	875 00	5,000 00	20,000 00
Lowell Institution for Savings.....	32,800 00	4	1,312 00	4,100 00	28,700 00
Lowell Institution for Savings.....	30,000 00	4	1,200 00	10,000 00	20,000 00
Commonwealth of Massachusetts.....	55,000 00	4	2,200 00	5,000 00	50,000 00
Sundry Persons.....	75,000 00	4	.....	.....	75,000 00
	\$1,229,800 00		\$49,307 00	\$30,100 00	\$1,274,700 00

TABLE VII.

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1900.

MAINTENANCE AND CONSTRUCTION STATEMENT.

MAINTENANCE.

Paid for Labor:	
Salary President and Superintendent.....	\$2,200 00
Office and Inspectors.....	8,683 38
Pumping Stations.....	18,360 20
Meter Work	2,350 90
Engineering.....	1,291 87
General Maintenance	18,034 89
Cost of Material:	
Output as per Stock Book.	1,200 75
Interest	49,307 00
General Expense.....	5,260 88
Stable.....	1,819 71
Machinery and Tools.....	504 70
Pumping Station Supplies.....	2,619 76
Coal.	21,303 35
Total	<hr/> \$132,937 39

CONSTRUCTION.

Paid for Labor:	
Extension, Construction and New Services..	7,677 29
Cost of Material:	
Output as per Stock Book	5,191 79
Payment on Loans.....	30,100 00
	<hr/> \$42,969 08

TABLE VIII.

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1900.

DRIVEN WELLS ACCOUNT.

Amount of Loan.....		\$75,000 00
Pay Roll....	\$ 7,558 56	
Alterations at Pumping Station		
No. 4	2,082 15	
New Engine and Foundation....	1,615 11	
Iron Pipes, Gates, etc.....	15,278 55	
Miscellaneous	1,510 39	
Land.....	28,278 26	
Paid Water Works Department.	6,105 22	
	<hr/>	62,408 24
Balance Dec. 31, 1900.....		<hr/> \$12,596 76

Superintendent's Report.

LOWELL, MASS., January 1, 1901.

To the Lowell Water Board:—

GENTLEMEN,—In compliance with the City Ordinances I herewith respectfully present to your Honorable Body the Annual Report of the Superintendent of Water Works upon the general condition of the works and the operation of the same for the year ending December 31, 1900.

Reference was made in my last report to the fact that at the close of the year 1899, in accordance with your vote and the recommendation of the State Board of Health, a test was begun of the Beaver Brook Valley for a water supply, by means of driven wells. After a careful observation of the topography of the territory adjacent to the brook in Dracut and Pelham, a site was finally selected near the State line dividing Massachusetts and New Hampshire and in the vicinity of the brook about two miles above Collinsville dam. According to every indication this was a most favorable place for the purpose. It comprised a large tract of upland meadow apparently free from stone and peat. Fourteen wells were driven at various points covering an area of about one square mile, some of which yielded abundantly. Samples of the water were, as you

know, collected, examined and analyzed by the State Board of Health. Their report showed more carbonic acid than was desirable and rather too much iron in some of the wells. In all other respects the water was very good. As the pipe used in making the wells was old, some of it having been in service at the Hydraulic Plant, it is probable that after more extensive pumping and cleaning of the wells other samples taken would have given more favorable results. Before anything could be done in this direction, however, pursuant to your instructions further experimenting there was abandoned and the men and tools transferred to the Boulevard Wells on January 22d. Since then all but three of the fourteen wells were pulled up; but for future reference, a plan was made showing where they were located, giving the capacity per minute of each well, with other pertinent data.

A few test wells on land owned by the Department between the Boulevard and river north of the present No. 4 Pumping Station demonstrated unmistakably the feasibility of extending the Boulevard well system, and as a consequence 52 2 1-2-inch wells were successfully connected in May, thereby increasing the total daily pumpage from 4,250,000 gallons to 6,250,000 that being the utmost capacity of the pumps at the Pumping Station. The still further extension of this plant which was authorized by the City Government in the passage of the \$75,000 loan last August, is now well under way. The enlargement of No. 4 Pumping Station which was also provided for in this loan is completed and the new three million pumping engine and the two new 54-inch x 16-foot boilers set in place ready for connecting. The greater part of the new

24-inch force main and about one-half of the 16-inch and 14-inch suction pipe is laid, also the laying of the 20-inch bell and spigot pipe connecting the fifty-two new wells directly with the pumps is nearly finished. The increased quantity of water acquired by the extension of the Boulevard system so far, has enabled the Department since last May to get along with taking a comparatively small proportion of the supply from the Cook or Hydraulic Wells. Both of these plants, however, are fully capable of yielding as much water as ever, and with the completion of the new Boulevard Plant and the consequent dispensing with them as a permanent supply, they still can be relied upon in case of an emergency, such as an accident to the pumping machinery at the other stations or a serious break in the conduit force main or river pipe.

FILTER INLET, GALLERY AND CONDUIT.

Although at no time during the year was there any necessity of using the Filter Gallery or Inlet nor any prospect of their being called into requisition for years to come, yet they have been regularly inspected with a view of not allowing deterioration to take place so as to impair their efficiency when needed. Repairing a break in the new 30-inch conduit pipe on West Sixth near West Street was the only expense incurred on the line between the Boulevard Station and No. 1 Station, Centralville, during the year, excepting the care of the enclosed grounds or parks on the conduit and tunnel.

RESERVOIR.

The work of beautifying the reservoir grounds and

making them more attractive to the public begun in 1899 was continued during the past year.

Some necessary repairs were made on the stone masonry of the gate house, otherwise the buildings were in good condition and the fences also.

It is now about fifteen years ago since the water was entirely drawn out of the reservoir for the purpose of cleaning the bottom and it certainly ought to be done again soon, even at the risk of the slope paving sliding out of place, as it did previously.

PUMPING STATIONS.

Pumping Station No. 1: Since the Boulevard pumps were speeded up to send six and one-quarter million gallons down the conduit to this Station, the Low Duty Worthington and Morris having only five millions capacity each, were consequently inadequate and had to be put out of commission, the whole work thereby devolving on the High Duty Worthington which did the work required splendidly. But mechanical skill and ingenuity has never designed nor never will design a machine that is not subject to wear and liable to break down; therefore, it would seem to be simply the part of wisdom and prudence to be prepared for such an emergency. To be sure, the Department has in the Morris and the Low Duty Worthington two pumps that can jointly pump ten million gallons, but they are old machines, out of date, extravagant in the use of coal, one of them would have to be run with fifty-five lbs. steam pressure, the other with one hundred and fifty lbs., thereby requiring the use of all four boilers. It seems to me very important, almost imperative, that a new twelve million

modern High Duty Pumping Engine should be installed at this Station, especially when all the water used will have to be pumped at this Station.

Pumping cost per million gallons.....	\$6.53
Total pumpage.....	2,107,538,836 gals.
Coal on hand.....	1296 56-2000 tons.

Pumping Station No. 2, although pumping but a comparatively small quantity of water, averaging some weeks scarcely a million gallons per day, has had to run constantly in order to avoid roiling the water in the mains of that section of the city by starting and stopping. This necessitated retaining the full complement of engineers and firemen; thus making the pumping per million gallons very costly.

The boilers, pumps and everything at this Station are in good condition, with the exception of the smoke stack, a section of which about thirty feet long fell last October. The building was somewhat damaged where the broken pipe struck but has since been repaired. A new stack made of 3-8-inch metal should be procured the coming year.

Cost of pumping per million gallons...	\$15.99
Total pumpage.....	842,204,888 gals.
Coal on hand	694 22-2000 tons.

Pumping Station No. 3 was run twelve days during the year, pumping 31,421,136 gallons into Pumping Station No. 2. While shut down, several brass fittings including two lubricators were stolen from there, entrance being effected through a window. The matter was reported at

police headquarters, since then, the machinery has been denuded of brass fittings as a precaution in the event of another break being made into the building.

The condenser at this Station was removed to the Boulevard and the balance of the machinery will be as soon as the new Station is ready.

Cost of pumping per million gallons..	\$16.28
Total pumpage.....	31,421,136 gals.
Coal on hand.....	292 438-2000 tons.

At Pumping Station No. 4 the boilers and pumps have been severely tried during the past year, running constantly to their full capacity to do the work required of them. As a consequence, considerable repairs will have to be made on both boilers and engines as soon as the new machinery is started.

The smoke stack at this Station, like the one at No. 2, suffered the loss of thirty feet last September, where it broke the metal was as thick as brown paper. Fortunately, however, the new stack designed for the enlarged Station was in process of construction and was reared shortly after the old one fell. The new pump and boilers are exact duplicates of those at present in use, as are also the valves, gauges and other fittings. When the machinery, old and new, at this Station is in running order it will have a capacity of ten million gallons. To make room for the new boilers, the boiler room has been doubled in size and the engine pit enlarged in area 308 square feet, giving quarters much better adapted for the work than formerly. The new stack is 42 inches diameter, 80 feet high and made

of 5-16 x 1-4-inch iron with one set of three 5-8-inch cable guys and is situated in rear of buildings. A new 300 horse power heater has been placed in the engine room on the exhaust pipe with condenser brought, as before stated, from No. 3 Station. A 6-inch cast iron suction pipe for the condenser has been laid to the river and extended therein 100 feet, with an ample sized strainer at the end. All of the work in connection with this Pumping Station would be done and everything running now, but for the unusual delay in delivering material.

In the location lines and grades of the suction and force mains connecting the new wells, provision is made so that if, when the Boulevard wells are more fully developed and the possibilities of the territory thereabouts for yielding water more reliably ascertained, the Water Board of the future, financial conditions permitting, might deem it expedient to build a permanent pumping station at a point more central than the present one; or if the suggestion is adopted to do the pumping by electric power pumps, four or more situated at different sections of the well plant and operated from a power station on the other side of the river near the railroad where the coal could be handled with more economy; no material change would have to be made in the pipe system.

Cost of pumping per million gallons..	\$6.12
Total pumpage.....	2,087,509,143 gals.
Coal on hand.....	1298 226-2000 tons.

EXTENSIONS.

Owing to the liberal policy of your Honorable Board and your predecessors, very few inhabited streets of the

city are now without water mains. As a result, the past year, while no applications for water were refused, only 7816 feet of cast iron main pipe and 195 feet of 2-inch wrought iron pipe were laid. This is considerably less than in previous years. The longest extension was on Varnum Avenue beyond Fowler Road and the next longest was on Nelson Avenue for the Egan house. The total of cast iron main pipe laid to date and now in use is 127.78 miles.

FIRE SERVICES.

Included in the foregoing account of extensions are the following private fire services, granted upon application, the Department requiring the applicants to pay only the first cost of the work, allowing the free use of the water for the extinguishment of fires and the testing of fire appliances without rental:

Tremont & Suffolk Mills	....	Hall Street.
Hooper Knitting Co.	.....	Perry Street.
High School Annex	.....	John Street.
Waterhead Mills	.....	Lawrence Street.
Lowell Hosiery Co. to Dye House		Mt. Vernon St
Batchelder's Plug Factory	.....	Mt. Vernon St.
American Hide & Leather Co.	....	Perry Street.

GATES.

Twenty-two new gates were set on street mains during the year, making a total of 1188. Thirty-three wooden gate boxes, having become decayed so as to be dangerous to travel, were replaced by iron boxes and fifty-two gates were repaired.

HYDRANTS.

Ten (10) hydrants were added during the year and two discontinued, making a total of 1098 now in service, as follows:—

HYDRANTS, January 1, 1901.

KIND.		² Noz's.	³ Noz's.	⁴ Noz's.	Total.
Boston Machine.....			172		172
Chapman.....		3	105	49	157
Coffin.....			1		1
Corey.....			1		1
Eddy.....			32	1	33
Flush.....	458				458
Holyoke.....				1	1
Ludlow.....		3	184	1	188
Michigan.....			74		74
Newark.....			1		1
Perkins.....				1	1
Lowry.....	11				11
Total.....	469	6	570	53	1098

Twenty-nine (29) flush hydrant boxes were renewed and 281 hydrants were repaired.

PRIVATE HYDRANTS, January 1, 1901.

KIND.		1 Noz.	2 Noz's.	3 Noz's.	4 Noz's.	Total.
Boston Machine			1	8	.....	9
Chapman		1	4	1	5	11
Coffin				1	.....	1
Flush	3					3
Kenney			1			1
Ludlow			18	12	8	38
Michigan				3		3
Perkins			3	1	.....	4
Total	3	1	27	26	13	70

SERVICES.

As can be seen by the accompanying table, only 115 new services were connected during the year, increasing the total number now in use to 10,634. Forty-three were changed for new or larger pipe and thirty-five leaks in service pipes were repaired. The reduction in the number of services changed compared with other years is due to the refusal of the Department to change the service if the trouble could be remedied by cleaning or repairing the old pipe, which was done in many cases, saving money to the water taker and the city.

Two hundred and ninety-eight wooden service boxes were replaced by iron boxes and thirty-four others were repaired.

NEW SERVICES.

99 3-4-inch Iron Tin Lined Pipe .	3,733 feet
4 1-inch Iron Tin Lined Pipe .	91 feet
3 1-inch Iron Pipe . . .	363 feet
2 1 1-2-inch Iron Pipe . . .	61 feet
2 2-inch Iron Pipe . . .	187 feet
1 2-inch Iron Lead Lined Pipe .	42 feet
1 1-2-inch Lead Pipe . . .	24 feet
2 5-8-inch Lead Pipe . . .	54 feet
1 3-4-inch Lead Pipe . . .	111 feet
<hr/> 115	<hr/> 4,666 feet

Amount previously laid . . .	413,409 feet
Total now laid . . .	418,073 feet
Total services laid . . .	11,343
Total cut off at main . . .	761
Total reconnected . . .	52
Total now in use . . .	10,634

SERVICES CHANGED.

No.	KIND.	Changed to						Total feet.
		Iron 1-in.	Iron 1 1-2-in.	Tin lined 3-4-in.	Tin lined 1-in.	Lead lined 3-4-in.	Lead 5-8-in.	
2	1-4-inch iron	90.0	..	..	..	..	..	90.0
1	1-4-inch iron . . . . .	..	47.8	..	..	..	..	47.8
2	3-4-inch iron	51.8	..	..	..	..	..	51.8
28	3-4-inch iron . . . . .	..	..	658.5	..	..	..	658.5
3	1-4-inch iron . . . . .	..	..	..	108.0	..	..	108.0
2	3-4-inch iron . . . . .	..	..	..	..	21.6	..	21.6
1	3-4-inch iron . . . . .	..	..	..	..	..	9.9	9.9
1	1-4-inch lead	35.0	..	..	..	..	..	35.0
1	3-4-inch lead . . . . .	..	..	76.0	..	..	..	76.0
1	5-8-inch lead	40.0	..	..	..	..	..	40.0
48	Total	216.8	47.8	734.5	108.0	21.6	9.9	1138.0

METERS.

The number of new meters set the past year has dropped off materially as compared with previous four years, viz.: 1896, 622 meters were set; 1897, 676; 1898, 484; 1899, 413; 1900, but 326. The whole number now in use is 5,586; 51 per cent. of the number of taps.

Meters condemned	46
New meters set in place of old ones condemned	48
New meters set for private use	13
Meters discontinued	8
Meters frozen and burst	34
Meters cleaned and repaired	636

METERS RUNNING January 1, 1901.

Sizes.	5-8 in.	3-4 in.	1 in.	¹ 1-2 in.	2 in.	3 in.	4 in.	6 in.	Total.
Ball & Fitts.	1								1
Columbia....	64								64
Crown.....	2265	1548	279	14	16	2	5	2	4131
Desper.....	40	23	7						70
Duplex.....	5	8	5						18
Empire.....	67	29	2						98
Frost.....		4	1						5
Gem.....					5		2	2	9
Hersey.....	200	67	5	1					273
Lambert.....	103	63	7						173
Metropolitan		2							2
Nash.....	85	65	42						192
Niagara.....	1	1							2
Thompson...	6	20	3						29
Trident.....	123	29	1						153
Union.....	17	1		1					19
Worthington	159	26	52	67	32	7	8		346
Westingh'ose		1							1
	3136	1887	404	83	53	9	10	4	5586

PRIVATE METERS RUNNING January 1, 1901.

SIZES.	3-8 in.	5-8 in.	3-4 in.	1 in.	2 in.	Total
Columbia		4				4
Crown	1	25	22	2		50
Desper		1	3	1		5
Duplex		1				1
Empire		2				2
Frost		2	1			3
Hersey		5	1			6
Lambert		6				6
Nash		11	2		1	14
Thompson			1			1
Trident		1				1
Worthington				1	3	4
Total	1	58	30	4	4	97

REPAIR SHOP.

At no time in the history of the Water Works Repair Shop has it proved of such utility as during the past year. Particularly is this so because of the addition of an Eaton, Cole & Burnham pipe cutting and threading machine purchased by your authority. This machine cuts and threads all sizes of pipe from 1-inch to 6-inch inclusive, thus enabling the Department to do practically all of its own pipe cutting, being of especial advantage in cutting and threading the large amount of pipe used for the new wells. By its use, every part of the work on the strainers or well points which must be used on every well, is done by the employees of the Department. Since it was first started over ten thousand feet of 2 1-2-inch tubing has been cut and threaded in various lengths.

During the year the old 1 7-16-inch main shafting which has done duty since 1886 was replaced by one of 1 15-16-inch diameter with larger and heavier hangers. The old shafting after being straightened was put in service as a second line for running the pipe machine, shaper and brass lathe. In connection with the brass finishing work a foundry has been established in the boiler room where all the composition castings needed by the Department are turned out when wanted without waiting for weeks as had been the case in the past. It also affords a ready means for the disposal of old brass and composition metal which is constantly accumulating around a shop of this kind, where repairs on valves, hydrants, meters, pumps, etc., are going on every day.

Neither the operation of the pipe machine nor the

work required in the foundry will cause any increase in the permanent force of the Department.

SUMMARY.

Total gross pumpage for the year .	5,068,674,000	Gallons
Total pumped into High Service .	65,472,694	"
Total pumped at Pumping Station No. 3	31,421,136	"
Total pumped at Pumping Station No. 4	2,087,509,142	"
Total net pumpage	2,884,271,028	"
Estimated quantity syphoned from Pumping Station No. 3 and pumped at Pumping Station No. 2	181,100,000	"
Number of tons of coal consumed in pumping	5,458 961-2000	
Total expense of pumping	\$42,513 84	
Average cost of pumping a million gallons based on expense of pumping:—Low Service	\$13 90	
Average cost of pumping a million gallons based on expense of pumping:—High Service	\$24 11	
Charges for water by metered rates	\$142,544 67	
Charges for water by schedule rates	75,853 59	
Total charges	\$218,398 26	
Total receipts	\$210,149 93	
Total expenditures	\$202,634 80	
Expended for maintenance	\$83,680 39	

Expended for maintenance and interest	\$132,937 39	
Average cost of a million gallons based on maintenance and interest	\$46 09	
Total consumption of water	2,881,074,794	Gallons
Average daily consumption	7,893,356	"
Per capita consumption based on 95,000 population	83	"
Price received per million gallons consumed	\$72 94	
Price charged per million gallons meter rates	\$167 96	
Number of services in use	10,634	
Number of meters in use	5,586	
Number of fire hydrants in public service	1,098	
Total length of mains in miles	127.78	
Total Water Works debt	\$1,274,700 00	
Amount in Sinking Fund	287,226 20	
Net debt on account of Water Works	\$987,473 80	

CONSUMPTION.

The total quantity of water used and wasted during the year was 2,881,074,994 gallons making a daily average of 7,893,356 gallons and a per capita consumption of 83 gallons. The average daily consumption exceeds that of last year 607,151 gallons and shows a gain over the consumption of water in 1890 of 2,519,820 gallons per day. About one-half of this increase took place in the last two years

and is chargeable in some measure to the flushing of lead pipes through fear of lead poisoning. Though these figures show an extraordinary waste of water, yet allowing for a corresponding increase the next ten years, giving a daily consumption in 1910 of 10,413,176 gallons, the quantity of water confidently expected from our new wells will be ample to meet the consumption at that time and by the judicious application of meters the consumption can be kept within the limits of our supply for the next twenty years.

In conclusion, I would state that each Pumping Station has a coal supply sufficient to last until July; and the Department has cast iron pipe enough of all sizes for any work in prospect, excepting 6-inch; about two hundred tons of this should be purchased at once.

Again taking pleasure in acknowledging my many obligations to the members of the Board and to the Clerk, this Report with accompanying tables and schedules is

Respectfully submitted,

ROBERT J. THOMAS,

Superintendent.

LOW SERVICE — WATER PIPES LAID IN 1900.

STREETS.	BETWEEN WHAT STREETS.	LENGTH IN FEET.					TOTAL.
		4-in.	6-in.	8-in.	10-in.	12-in.	
Alken Ave	Westerly to Hildreth	87					87.0
Arch . . .	Southerly from Middlesex . . .	6					6.0
Bodwell Ave	Northerly from Charles ave . .	98					98.0
Brewery Lane	Connection and blow-off to sewer	21					21.0
Burlington Av	Extended easterly	42					42.0
Campos . .	Wilder and Rolfe	442					442.0
Charles Ave	Easterly to Bodwell ave . . .	641 1-2					641.5
Cottage . .	Easterly from Chapel	223					223.0
Crescent . .	Extended northerly	96					96.0
Cumberl'd R'd	Southerly from Orleans st . . .	273					273.0
Dix	Northerly from Gorham	144					144.0
Foster . . .	Extended southerly	103					103.0
Green	Extended westerly	96					96.0
Hall	Fire service to T. & S. storehouse	12					12.0
High	Southerly from Rogers	185					185.0
Hildreth . .	By st northerly	824					824.0
Hooper Knit Co	Fire service from Perry st . . .	10					10.0
Houghton . .	Southerly from Plain st	99					99.0
John	Fire service to High School annex	26					26.0
Johnson . .	Southerly from Varnum ave . . .	336					336.0
Lawrence . .	Fire service to Waterhead mills	233 1-2					233.5
Lawson . . .	Westerly to School st	128 1-2					128.5
Lowell H's'y Co	Fire service from yard to dye house and engine house . . .	46 1-2	561-2				103.0
Marsh	Replaced 4-inch at Phillips . . .	52					52.0
Merrill . . .	Southerly and westerly from Lawrence	135					135.0
	Carried forward	559	3837 1/2				4396.5

LOW SERVICE—WATER PIPES LAID IN 1900. — *Continued.*

STREETS.	BETWEEN WHAT STREETS.	LENGTH IN FEET.					TOTAL.
		4 in.	6 in.	8 in.	10 in.	12 in.	
	Brought forward	589	383½				436.5
W. Vernon	Fire service to Kachelder's drug and paint factory	20					20.0
Nelson Ave	Southerly to Egan's house		125				125.0
Orleans	Easterly to Cumberland road		142				142.0
Everett	Easterly from Walker			60			60.0
Price	Fire service to Amer. Bldg. and Leather Co.		37½				37.5
Prussac	Northerly to Antover		125				125.0
Phillips	Terminal Ranch Broadway and Marsh		365				365.0
Pyralis	Offset in account of gas meter		132				132.0
Shaw Street	Offset in account of new building			47			47.0
St. Whipple	Extension southerly		35				35.0
Sacchar	Extension northerly		54				54.0
Seward	Southerly and westerly to Bannock		254				254.0
Union Ave	Extension westerly			60			60.0
Vernon Ave	Lower end of Egan's house		402				402.0
Wanderer	Offset in account of new building			151			151.0
	Hydrants		100				100.0
	Grand total	589	679	367			1635.0
	Less: taken up and disconnected in places Phillips, Pyralis and Wanderer Streets	41	100	121			262.0
	Total						1373.0
	Work done from Nov. 1 to Dec. 31, 1900						157.4

HIGH SERVICE — WATER PIPES LAID IN 1900.

STREETS	BETWEEN WHAT STREETS.	LENGTH IN FEET.					TOTAL.
		4-in.	6-in.	8-in.	10-in.	12-in.	
Third	Easterly to Llewellyn st	130					130.0
	Laid in 1900						130.0
	High Service laid previous to 1900						37285.5
	Total High Service to January 1, 1900						37425.5

Brought forward.....	7,032.0	feet
Low Service laid previous to 1900.....	630,252.0	"
Total Low Service to January 1, 1901....	637,284.0	"
Total High Service to January 1, 1901....	37,425.5	"
Total High and Low Service to January 1, 1901.....	674,709.5	"

Total in mile, 127.78.

LOW SERVICE—LIST OF STOP GATES SET DURING 1900.

STREETS.	LOCATION.	4-in.	6-in.	8-in.	10-in.	12-in.
Arch	15 feet north of south line Middlesex street, 17.3 feet east of west line Arch street	1				
Aiken Ave	13 feet north of south line Aiken avenue, on east line Hildreth street	1				
Brewery Lane	14 feet north of corner Franklin House, 13 1-2 feet east of railroad fence, on blow-off to sewer.	1				
By	8 feet north of south line By street, 3 feet east of east line Hildreth street	1				
Campos	11 feet south of north line Campos street, on west line Wilder street	1				
Charles Ave	12 feet south of north line Charles avenue, on west line Bodwell avenue	1				
Cottage	5 feet south of north line Cottage street, on east line Chapel street	1				
Cumberland Road	12 feet east of west line Cumberland road, on south line Orleans street	1				
Dix	9 feet south of intersection of east line Dix street, with west line Gorham street, and on west line Gorham street	1				
Dutton	On hydrant connection 23 1-2 feet south of south line entrance to Lowell Machine Shop, 9 feet west of east line Dutton street	1				
Gershom Ave	12 feet south of north line Gershom avenue, on east line Woodcock avenue	1				
Hall	On fire service to T. & S. storehouse, 14 1-2 feet north of south line Hall street, 80 1-2 feet west of west line Cabot street	1				
High	15 feet east of west line High street, on south line Rogers street	1				
Hildreth	35.3 feet east of west line Hildreth street, on north line Aiken avenue. (West of Hildreth)	1				
Hooper Knit Co	8.2 feet east of west line Perry street, 73 feet north of south line building	1				
Houghton	12 feet west of east line Houghton street, 26 1-2 feet north of south line Plain street	1				
John	On fire service to High School annex, 21 1-2 feet east of building, 25.3 feet north of Paige street line of building	1				
Johnson	12 feet east of west line Johnson street, on south line Varnum avenue	1				
Lawrence	On fire service to Waterhead mills, 10 1-2 feet west of east line Lawrence street, 5 feet south of post hydrant	1				

LOW SERVICE—LIST OF STOP GATES SET DURING 1900.

— Continued.

STREETS.	LOCATION.	4 in.	6 in.	8 in.	10 in.	12 in.
Lawson	14 feet north of south line Lawson street, on east line School street	1				
Lowell Hosiery Co.	Indicator gates in yard, to dye house and engine house	1	1			
Merrill	14 1-2 feet west of east line Lawrence street, 7 feet south of north line Merrill street	1				
Middlesex	On hydrant connection 17 feet north of south line Middlesex street, 23 feet west of west line Arch street			1		
Mt. Vernon	On fire service to Bachelder's bung and plug factory, 8 1-2 feet east of west line Mt. Vernon street, 13 1-2 feet south of north line building	1				
Perry	On fire service to Amer Hide & Leather Co, 12 feet east of west line Perry street, 10 1-2 feet north of south line Perry street (near angle)			1		
Phillips	12 1-2 feet west of east line Phillips street, 1 foot north of north line Broadway (replaced 4-inch gate)			1		
Pleasant	18.3 feet west of east line Pleasant street, on south line Andover street			1		
School	17 1-2 feet west of east line School street, on north line Westford street					
Stewart	12 feet south of north line Stewart street, on east line Baldwin street			1		
Varnum Ave . . .	13 feet south of north line Varnum avenue, on west line Boulevard extension			1		
Waterhead Mills	Indicator gate on fire service to Waterhead mills, in front office	1				

LOW SERVICE—LIST OF HYDRANTS SET DURING
THE YEAR 1900.

STREETS.	LOCATION.
Bodwell Ave . .	Easterly side on end of pipe.
By	Change, westerly side, 181 feet northerly to end of pipe.
Columbia	Easterly side, near Middlesex street.
Cumberland Road .	Westerly side, 261 feet south of Orleans street.
Ford	Change of hydrant, from Ford street to Aiken street, to Ford on east line Aiken street.
Hildreth	Easterly side, on terminus in front Burns' house.
Jewett	Changed, from West Sixth street at Jewett street to Jewett street, east side 52 1-2 feet north of "square."
Johnson	Westerly side, on end of pipe.
Nelson Ave . . .	Westerly side in front of Egan house.
Oakland	On end of pipe, 97 feet north of Parker street
Varnum Ave . . .	Northerly side, opposite Forrest house.
Waterhead Mills .	Off Lawrence street, in rear of mill. (Private.)
West Sixth . . .	Northerly side, in front house, No. 257.

**HIGH SERVICE—LIST OF HYDRANTS SET DURING
THE YEAR 1900.**

STREETS	LOCATION
Fairmount	Changed hydrant, westerly side, from in front No. 300 to feet northerly.
Third	Changed, northerly side, to 3 feet west of Llewellyn street

Stock on Hand January 1, 1901.

CAST IRON PIPE IN PIECES.		FLANGE PIPE.	
Six feet 30 in.....	\$ 10.00	Two lengths 24 inch.	96.00
Fifty-nine feet 24 in..	60.00	Three lengths 12 inch	72.00
Sixty-four feet 20 in..	50.00	Eleven lengths 10 in.	176.00
Thirty-six feet 16 in..	18.00	One length 8 inch....	12.00
Thirty-nine ft. 12 in..	16.00	Seven lengths 4 inch.	30.00
Thirty-two feet 10 in..	14.00		
Forty-six feet 8 in...	11.00	FLANGE SPECIALS.	
Fifty-six feet 6 in....	9.00	One 10 in. x 8 in. x 6	
Sixty-five feet 4 in...	14.00	in. fourway.....	4.50
One manhole.....	11.00	Five 16 inch x 12 inch	
One 24 inch clamp		threeways.....	30.00
sleeve.....	20.00	One 12 in. x 12 in. x 20	
Twenty old logs.....	2.00	in. threeways.....	20.00
One 6 in. check valve.	12.00	Five 10 in. x 8 in. x 6	
Twenty-eight hundred		in. threeways.....	22.50
feet 4 inch x 4 inch		Six 12 in. x 10 in. x 6	
kyanized spruce...	45.00	in. threeways.....	75.00
HYDRANTS.		Two 8 in. x 8 in. x 6 in.	
Six 6 inch Ludlows..	180.00	threeways.....	8.00
One 6 in. Michigan old	5.00	Three 6 1-4 in. bends.	8.00
One 6 inch threeway		One 10 1-8 in. bend..	4.00
Chapman.	15.00	Two 10 1-4 in. bends.	14.00
One Lowrey.....	20.00	One 4 1-4 in. bend...	1.80
One flush, old.....	5.00	One 6 in. sleeve.....	3.40

Stock and Tools at Shop, Hampshire Street.

One 8 inch x 10 inch slide valve engine.	200.00	Forty-two turning tools.....	25.00
One 10 foot engine lathe.....	300.00	Ten steel arbors	10.00
One 7 foot engine lathe.....	250.00	Two meter reamers..	10.00
One 5 foot speed lathe	50.00	Twenty-one taps...	25.00
One 6 foot brass lathe	350.00	Three tap wrenches..	3.00
One 6 in. pipe cutting and threading ma- chine	700.00	One hand vise .....	.50
One shaper	200.00	Four bench vises.....	12.00
One upright drill....	175.00	One pipe vise	10.00
One emery wheel ...	40.00	Three small platform scales	15.00
One grindstone	75.00	One large platform scales	100.00
Two soldering furna- ces	10.00	One counter scales..	1.50
One large end chuck.	25.00	One Smith tapping machine.....	400.00
Two independent chucks	50.00	Six tapping machines with rubbers.....	500.00
Two drills....	10.00	Six shaft hangers...	12.00
Ten lathe dogs.....	5.00	Forty-four tools for brass lathe.....	44.00
Twenty reamers... ..	40.00	Twelve sets.....	1.00
Ten twist drills.....	25.00	Thirteen cast iron chucks	40.00
Eight flat drills	8.00	One set hand chas- ers	10.00
Twelve flat chucking drills	12.00	One set broachers...	5.00
One 1 inch drill.....	4.00	Twenty-five tools for brass work	25.00
One 1 1-4 inch drill..	4.00		

One set wooden patterns for 3-4 inch sidewalk cocks....	15.00	One gate of 4 brass patterns for 3-4 in. tail pieces.....	15.00
One set wooden patterns for 1 inch sidewalk cocks ...	25.00	One gate of 4 brass patterns for 3-4 in. smooth tail pieces.	15.00
One set wooden patterns for 1 inch corporation cocks.....	25.00	One gate of 4 brass patterns for nuts for 3-4 inch cocks.....	5.00
One wooden pattern complete for 2 inch plug cock.	25.00	One gate of 4 brass patterns for washers for 3-4 inch cocks.	5.00
One wood and two brass patterns for handles for cellar cocks	5.00	One gate of 4 brass patterns for 3-4 in. x 1-2 in. couplings.	15.00
One gate of 4 brass patterns for 3-4 inch sidewalk cocks....	25.00	One gate of 4 brass patterns for 3-4 inch thimbles.....	15.00
One gate of 4 brass patterns for 3-4 inch corporation cocks .	25.00	Two large wooden patterns for heads for pumps.....	40.00
One gate of 4 brass patterns for plugs for 3-4 inch sidewalk cocks.	25.00	One wooden pattern for packing box for pumps	5.00
One gate of 4 brass patterns for plugs for 3-4 inch cellar cocks.....	25.00	Two large wooden patterns for nuts.....	1.50
		Two plunger rods for pumps.....	50.00
		One Gow meter testing machine	100.00

One Howe pump		Two best pigs	50
Spikes and nails etc		One large oil can	50
Testing machine	500.00	Four small oil cans	50
Eleven Wilson wrench		One lat stock and set	
does	10.00	of bits	2.00
Nine S wrenches	4.00	One set chisels	2.00
Thirteen first hydrant		One belt punch	.50
wrenches	20.00	One set steel figures	3.00
Eight post hydrant		Two cut nippers	3.00
wrenches	8.00	One naptha can	.50
One gate hydrant		Two back saws	2.00
wrench	5.00	One clock	2.00
Six taps and drills	50.00	One pair scissors	.50
Three tap wrenches	24.00	One pair snips	1.75
One set plumbers tools	5.00	One saw set	.50
One line 2 in. shafting		One desk	5.00
and pulleys	150.00	Two gate plans	1.00
One line 1 1-2 inch		One marlin spike	1.00
shafting and pulleys	50.00	Two naptha lamps	1.00
Seven hangers for 2		One Lowell Water	
inch shafting	20.00	Works seal	10.00
Four hangers for 1 1-2		Tools for sealing fire	
inch shafting	10.00	services	5.00
Belts and belting	100.00	Two step ladders	10.00
Two naptha furnaces	6.00	One map of water	
One pair round nosed		mains	500.00
pliers	.50	Three die stock ratch-	
Twenty files	2.00	ets	1.50
Three soldering irons	3.00	One chair and 3 stools	2.00
Six screw drivers	1.50	One floor brush	1.00

One mirror.....	.50	Six ft. 6 in. wrought	
One waste can.....	1.00	iron pipe.....	1.00
One pipe bench	5.00	Fourteen feet 4 inch	
One nozzle	5.00	soil pipe.....	1.00
One brass Dutch-		Eight ft. 6 in. soil pipe	.75
man.....	25.00	One 12 inch earthen	
One iron Dutchman.	10.00	elbow.....	.50
Six lbs. iron wire ...	.25	Fifty-five 3-4 in. iron	
Ten lbs. brass rod....	2.50	sidewalk boxes....	82.50
Five lbs. copper wire.	2.00	Fifteen 1 inch iron	
One lead reel	1.25	sidewalk boxes....	22.50
One pipe rack.....	25.00	Ten 2 inch iron side-	
One length 6 inch		walk boxes.	15.00
flange pipe.....	2.50	One stone drag.....	10.00
One length 4 inch		Sixty-eight caps for	
flange pipe.....	1.75	sidewalk boxes....	10.00

Property and Tools at Tool House.

Twenty-five cedar		One pipe testing ma-	
posts.....	\$ 20.00	chine.....	15.00
One hundred and fifty		Five meter box cast-	
bricks ...	.50	ings	1.00
One lawn mower...	3.00	One sluice gate	2.00
Two derricks.	150.00	Nine covers and frames	
One iron part of drink-		for gate boxes ...	9.00
ing fountain.	1.00	Two coke furnaces for	
One drinking foun-		melting lead.....	10.00
tain.....	25.00	Fifty ft. 4 in. x 4 in.	
Two saw horses. ....	.50	kyanized spruce...	1.00
Six wheelbarrows, old	1.50	Six bridge bolts.....	6.00

One rubber wagon spring . . . . .	.50	Two hundred feet 3-4 inch iron cable	5.00
Six 3 feet iron exten- sions	4.50	Six long handle shov- els	3.00
Eighteen 2 feet iron extensions	9.00	One window frame and screen . . . . .	.30
Twenty-five 1 ft. iron extensions	10.00	Two iron hoops	1.00
Thirty-four plugs for sidewalk boxes	3.00	One iron for cant hook . . . . .	.25
Two pipe benches	8.00	Twenty - t h r e e old doors	5.00
One mortar box	1.00	Three double windows	1.50
Four odd gate boxes	4.00	Three transom win- dows	1.00
Five caps for gate boxes	1.25	Fifteen old windows	2.50
One screen for filter gallery	12.00	Two painter's horses	2.00
One wagon jack . . . . .	.50	Two 8 ft. horses	4.00
One carpenter's bench	10.00	Four driving mauls	5.00
One templet for hy- drant box	1.00	One 12 ft. fence gate	1.00
One templet for gate box	1.00	Half keg spikes . . . . .	.75
One copperhand pump . . . . .	.50	Six 2 ft. horses	2.00
Six slings	3.00	One grate for coke furnace	1.00
Six dog troughs	1.50	Two door hangers . . . . .	.50
Five bridge hangers for pipe	3.50	Ten feet of track . . . . .	.50
One 16 inch earthen sleeve . . . . .	.25	One apron for drink- ing fountain . . . . .	.50
		Two l o n g handle scoops	1.00
		One 5 ft. step-ladder	1.50
		One scoop shovel	1.00

One chain.....	1.00	One hose spanner....	.25
One broom.....	.50	Two flush hydrant	
One galvanized iron		wrenches.....	2.00
pail.....	.50	Eight square pointed	
One pattern for boiler		shovels.....	4.00
front.....	2.00	Ten wooden mauls...	10.00
One pulley for electric		Four hand saws, old..	3.00
motor.....	5.00	Twenty-five ft. 1 in.	
One 15 ft. ladder....	3.00	rubber hose.....	2.50
One 10 ft. ladder....	2.00	Five paving mauls...	5.00
Three wheelbarrows		Eleven hoes.....	5.50
for barrow men...	4.50	Nine striking ham-	
One 12 ft. straight		mers.....	5.00
edge.....	2.00	Five ladles....	15.00
Five tool boxes.....	20.00	Eleven gate wrenches	35.00
Thirty lanterns.....	12.00	Five iron blocks and	
Two 6 inch wooden		falls.....	30.00
plugs.....	.50	Six tag ropes.....	3.00
Two 8 inch wooden		Four rock chains....	20.00
plugs.....	.50	One log chain.....	5.00
One 12 inch wooden		Eighteen pick handles,	
plug.....	.50	old.....	4.50
Two iron bars for fur-		Four steel tunnelling	
nace.....	1.00	bars.....	5.00
Two manhole steps..	.25	One steel tamping bar	1.50
One 3-4 in. brass valve	1.00	Four hatchets...	2.00
Two post hydrant		One oil tank and pump	5.00
wrenches.....	1.00	Two tunnels.....	.20
Six picks.....	2.50	Five gals. kerosene oil	.50
Six round pointed		Three sledge hammers	4.50
shovels.....	3.00	Three lead pots.....	10.00

One long handle digger	1.00	Five paint brushes	.50
Six sidewalk wrenches	6.00	Twelve paint pans	1.00
One 12 inch monkey wrench	.50	One funnel	.50
One single wagon tree	1.00	Forty-five cast iron gate boxes	185.00
One top for gate wrench	.50	Two handles for tool boxes	.50
One sink trap	.50	Thirty feet 10 inch wooden spout	5.00
Two 5-8 in. lead goose necks	1.00	One wagon jack	1.00
One 2-horse mowing machine	25.00	One crow bar	1.50
Five oil barrels	2.00	Five hundred lbs. old rope	1.00
Nine hundred 5 ft. fence pickets	25.00	Fifty feet old rubber hose	.50
Two hundred 4 ft. fence pickets	5.00	One set wooden clamps	.50
One 1-2 barrels cement	3.00	One part 6 inch well cleaner	.50
Three squares sheet iron	1.00	Two basins for drinking fountain	.50
One electric motor	25.00	One roof staging	2.00
One centrifugal pump	100.00	Two pulleys for staging	.50
One hundred and thirty feet 1 inch steam pipe	5.00	Eight portions of 2 in. well cleaners	3.00
One stone hand barrow	2.00	One cupboard	1.00
One jack and bar for bracing	1.00	Three slings for staging	1.00
		One door spring	.25

Four pipe hangers...	6.00	Five gals. varnish....	15.00
Four 2 inch tees ....	.60	Half gal. raw oil.....	.40
Two gals. linseed oil.	.50	Two gals. turpentine.	.50
Two gals. dryer.....	1.00	One bbl. engine oil ..	15.00
Two gals. liquid dryer	1.00	One bbl. cylinder oil.	23.00

Property and Tools at Stable.

One sorrel horse, Dandy.....	100.00	Seven curry combs and brushes.....	10.00
One chestnut horse, Ned ..	125.00	Six brooms.....	1.50
One bay mare, Kitty.	125.00	Six hay forks.	3.00
One black horse, Tom	100.00	Twenty-five ft. 1 in. rubber hose.....	2.50
One bay mare, Nellie	200.00	One string of bells...	1.00
One bay mare, Lottie	225.00	Two chamois.....	2.00
One roan horse, John	175.00	Two 4 qt. measures..	1.00
Ten single harnesses.	350.00	One axe.....	1.00
One set double harness.....	40.00	Fifteen sponges.....	5.00
One new harness....	50.00	One feed box.....	.50
One single truck....	150.00	One wagon jack....	1.00
One double truck....	100.00	One hay cutter	5.00
Seven sleighs.....	200.00	Nine whips	1.00
One Goddard buggy.	100.00	Eight street blankets	50.00
Six wagons.....	900.00	Three lap robes	5.00
Two democrat wagons	225.00	One wolf-skin robe...	5.00
One dump cart.....	100.00	One scythe.....	.50
Fourteen stable blankets, 7 new, 7 old...	31.00	Two large sun shades	1.00
		Two wagon covers...	40.00
		One cupboard.....	1.00

One round pointed shovel .....	.50	Six tons hay	120.00
One bench	1.00	One work bench	5.00
Seven fly nets	5.00	One 1-4 wool skin .....	.50
Five harness hooks .....	.50	Ten lbs. harness leather	4.00
Three hitch ropes .....	.50	Twenty lbs. scrap leather	5.00
Seven halters	2.00	One set sleigh bells .....	.80
One snow shovel .....	.50	Six 1 1-4 inch roller buckles .....	.10
Four bale hooks .....	.50	Five 1 inch roller buckles .....	.10
One carriage top	5.00	Two 1 3-4 inch rings .....	.10
One scoop shovel	1.50	Twelve 1 1-8 in. rings .....	.25
Seven storm covers for horses	7.00	Six 7-8 inch rings .....	.10
Three-quarters bbl. of Standard Food	8.00	One pair 1 1-4 inch trace buckles .....	.25
Forty lbs. rock salt .....	.25	Four rubber girt buckles .....	.30
Twelve lbs. axle grease	1.00	Half package tacks .....	.05
Three galvanized iron pails	1.50	Half box cushion buttons .....	.10
Two qts. harness oil	2.00	Two packages 8 oz. tacks .....	.20
Fifteen hundred lbs. rye straw	13.00	Six spools linen thread .....	.50
Two hundred bush. oats	68.00	Two balls Renfrew thread .....	.50
Two boxes Eureka powders	1.00	Eight balls super thread	1.00
Two stall hooks .....	.50	One ball buttoning twine .....	.10
Two hoof picks .....	.25		
Twelve harness hooks	1.00		
One box harness blacking .....	.25		

One 1-2 sheets saddle felt	1.25	Half doz. 5-8 inch nickle rings .....	.15
Half sheet yellow felt .....	.75	Five balls Barbour thread.....	.40
Four second bits ....	.25	Seven balls No. 10 Barbour thread....	.60
Two sets second-hand heavy harness.....	20.00	Eight balls harness wax.....	.10
Half lb. copper rivets .....	.20	One 1-2 sheets sheep-skin .....	.50
One pair second-hand hames .....	.50	Eight 1 1-2 in. nickle buckles.....	.40
Four pair shaft tips..	1.00	Ten new slide loops..	.50
Four 1 1-2 in. nickle lug dees.....	.30	Five new harness straps	1.25
One doz. 1 1-2 inch nickle rings... ..	.30	One second-hand cushion .....	.50
One pair 2 in. nickle rings.....	.20	Three manure forks..	1.50
Three 1 1-4 in. nickle buckles.....	.30		

Property and Tools at Blacksmith Shop.

One forge and bellows	\$300.00	One draw knife.....	1.00
One steel square	1.50	Two Lowell Water Works stamps ..	2.00
Nine hand punches...	4.50	One portable forge...	10.00
Thirty-one blacksmith tools	30.00	Two closets.....	3.00
Fourteen pair tongs..	14.00	One pair pliers	1.00
One work bench.	1.00	One grub pick	1.00
One pair dividers ...	5.00	One coal hod.....	.50
One bench vise.....	3.00	One coal shovel .....	.50

REPORT OF THE WATER BOARD

22

Two hundred and		Six steel wedges	2.00
twenty-four in. 1-4		One gate wrench	2.00
inch steel drills	240.00	One submersible pump	1.00
Eighty-nine feet 1-4		One tin	.25
inch steel drills	200.00	Two 1/2 in. 1-4 in.	
Twenty-nine in. 1 in.		wrenches	4.00
steel drills	10.00	One ice tong	.25
Nine spades	5.00	One handle for lead	
One broom	.50	pick	.50
One spade	.50	One ice chisel	.50
One blacksmith's saw	5.00	Eighty-three rings for	
One tag rope	1.00	hydrants	4.00
Two anvils	6.00	Five hundred lbs. nuts	
Six cutters	3.00	and washers	3.00
Three hundred lbs. old		Seven drive well	
iron	5.00	clamps, old	21.00
Twenty lbs. machine		Two lbs. borax	.20
steel	3.00	Four cold chisels	2.00
Thirty lbs. tool steel	4.00	Four hooks for tag	
Twenty-four picks	18.00	rope	1.00
Two stone chains	15.00	Fifteen 1-4 in. iron	
Seven crowbars	10.00	bolts	1.50
Three pick handles	.30	Twenty unfinished	
One water pail	.50	caulking sets	10.00
One hundred and fifty		One stone point	1.00
lbs. coal	.75	One chain hook	.50
Three hundred sixty-			
seven unfinished nuts	5.00		

Property and Tools at Foundry.

One core oven	5.00	Five crucibles	10.00
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REPORT OF THE WATER BOARD.

One No. 5 brass		Five lbs. jeleluice...	.25
moulder's furnace.	50.00	Three plaster of paris	
Two ingot plates	3.00	matches	15.00
Two pair crucible		Six core plates	5.00
tongs	3.00	One core bench.....	2.00
One crucible bail....	3.00	One pair blowers....	1.25
Two moulder's trowels	1.00	Eighty lbs. pig copper	15.00
Two moulder's sewers	1.50	Five gates brass pat-	
One pair rammers....	1.50	terns.....	25.00
One watering pot....	.50	Sixty lbs. plaster of	
Sixteen moulder's		paris.....	1.00
flasks	24.00	Fifteen hundred lbs.	
Half keg parting sand	5.00	coal.....	4.50

Property at Superintendent's Office.

One roll top desk....	35.00	One mapcity of Lowell	1.00
Two desks	25.00	Three bill files	1.50
One set drawers and		One water gauge	1.00
book-case	20.00	One test gauge.....	5.00
One small book-case..	5.00	Two ink stands .....	.50
One Howard electric		Twoelectricflashlights	4.00
clock,	50.00	One letter press.....	5.00
One gate plan .....	.50	One Webster diction-	
One diagram	2.00	ary.	5.00

Property and Tools at Reservoir, Low Service.

Two lawn mowers	10.00	One monkey wrench.	.50
One wooden rake	1.00	One long handle hoe.	1.00
One garden rake.....	1.00	One axe .....	.50

One wooden shovel	.50	Three round pointed	
One ice chisel	.50	shovels	3.00
One lantern	.50	One hundred fifty ft.	
One broom	.50	3-4 in. rubber hose	18.00
One pail	.50	One hand saw	1.00
One garden wheel-		One buck saw	.50
barrow	1.50	One sprinkling pot	.50
Two square pointed		One turf cutter	.50
shovels	2.00	One pair sheep shears	1.50

Filter Basin House.

One hoe	1.00	One ice hook	.50
One gate wrench	2.00	One ice rake	.50
One ice chisel	.50	One ice dipper	.50

Property and Tools at Inlet Chamber House.

Sixteen screens	160.00	One snow shovel	1.00
One gate wrench	2.00	Fifty ft. 1 in. rubber	
Two sets iron blocks		hose	8.00
and falls	10.00	One broom	.50
One boat	5.00	Two sq. p'ted. shovels	2.00
Three tag ropes	3.00	One ice rake	.50
One tee wrench	1.00	One wooden rake	1.00
One round pointed		One wheelbarrow	.50
shovel	1.00	One pick	.75

Bodwell Gate House.

One round pointed		One pick	.50
shovel	1.00	One gate wrench	2.00

One 1 in. x 3-4 in. iron coupling . . . . .	.10	One sidewalk wrench	1.00
One 3-4 in. sidewalk cock	1.25	Eight feet 1 1-4 inch iron pipe . . . . .	.50
		One 3-4 in. brass nipple	.15

Property and Tools at Pumping Station No. 1.

One High Duty Worthington engine	30,000.00	Four socket wrenches	5.00
One Low Duty Worthington engine	10,000.00	Two monkey wrenches	1.00
One Morris engine	15,000.00	One 2 ft. steel square	1.50
One Worthington pump for High Service	1,000.00	One copper hammer . . .	.50
		One hammer	1.00
Eleven High Duty engine wrenches	30.00	Two jack screws	10.00
Five Low Duty engine wrenches	25.00	One tool cupboard . . .	5.00
Five Morris engine wrenches	25.00	One set differential blocks	10.00
Two oil dishes	2.00	One brass hydrant . . .	10.00
One set oil cans	5.00	Two platform scales . . .	30.00
Six drills	5.00	One bay scales	150.00
One oil filter . . . . .	.50	Three ladders	15.00
One cold chisel . . . . .	.50	One lantern . . . . .	.40
Two bats	1.00	One barometer	1.00
Two bat stocks	1.00	Three thermometers . . .	1.50
One level	1.50	One iron wheelbarrow . .	1.50
One keyhole saw . . . . .	.50	Two iron pails	1.00
One back saw . . . . .	.50	Two indicators	5.00
		One steam gauge	5.00
		One broom . . . . .	.50
		One floor brush	1.00
		One gas lamp and tubing	1.50
		One 24 inch elbow	50.00

Two clocks.....	6.00	Two long handled	
Three chairs.....	5.00	scoops.....	3.00
One table.....	2.00	Two No. 5 scoop	
Two mops.....	.50	shovels.....	3.00
One dustpan.....	.25	One coal hammer....	1.00
Five cuspidores	2.50	One slicer.....	2.00
Four Stillson wren-		One hoe.....	1.00
ches	2.00	Twenty-five ft. steam	
One extra check valve		hose	12.00
for High Duty en-		One oil can.....	.50
gine.....	100.00	Eight sheets emery	
One set drawings for		cloth.....	.10
High Duty engine..	25.00	One screw driver....	.25
One ratchet.....	1.00	Half bbl. Kleansall...	5.00
One flue scraper.....	2.00	Two lbs. Daniels pack-	
One rake.....	.50	ing	1.50
One bar.....	1.00	Twenty lbs. Garlock	
One oil cupboard....	2.00	packing	15.00
Nine 5 inch rubber		Twenty-eight 1-8 lbs.	
valves	9.00	Knowlton packing.	28.00
Fifty gals. Harris en-		Ninety springs for	
gine oil	12.50	High Duty engine.	9.00
Fifty-one gals. Woods		Forty-five plates for	
cylinder oil.....	22.95	High Duty engine.	10.00
Forty-eight 1-2 gals.		One section of grates	
Valvolene cylinder		with bars	25.00
oil.....	21.83	Three center bars....	5.00

Property and Tools at Pumping Station No. 2.

Two Dean steam		One Dean feed pump.	100.00
pumps.....	4,000.00	Three thermometers..	1.50

One platform scales..	5.00	One ice chisel.....	.50
One 30 ft. Howe scales	150.00	Two long handle shov- els	2.00
One map of city of Lowell	10.00	One slice bar.....	.50
One desk.....	3.00	Two brooms.....	.50
Four chairs	5.00	Two boiler hoes.....	1.00
One 20 ft. ladder....	5.00	One iron wheelbarrow	1.50
One 15 ft. ladder....	3.00	Three large lamps....	6.00
Three 60 gal. oil tanks	15.00	One hundred feet cot- ton hose	25.00
One iron tube scraper	2.00	One gal. measure ...	.50
Three lanterns.....	1.00	Three Stillson wren- ches.....	1.50
One stool .....	.50	Eighteen lbs. cotton waste	1.00
One grindstone.....	2.00	Two gals. machine oil	.50
Two square pointed shovels	2.00	Twenty-four gals . kerosene	2.40
One vise bench.....	2.00	Thirty gals. cylinder oil	13.50
One work bench.....	3.00	One tunnel.....	.10
One clock.....	3.00	Two oil cans.....	.50
Four cold chisels....	2.00	Two water tumblers..	.20
Three monkey wren- ches	1.50	Two lbs. hemp pack- ing	1.00
Seven socket wren- ches	3.50	Ten spindles for Dean pump	10.00
Two crowbars.	3.00	One small jack.....	1.50
Three gate wrenches.	6.00	Seven dies.....	3.50
One striking hammer.	1.00	Two die stocks	5.00
One coal hammer ...	1.00	Eight gauge glasses..	1.00
One sledge hammer..	1.00		
Two long steel chisels	2.00		
Three taps.....	1.50		

One ring for water piston	5.00	Five lbs. mop waste . .	.25
One 1 inch tap	1.50	Two 8 in. air chambers.	20.00
One 3-4 inch tap	1.00	One 6 in. iron elbow . .	2.00
One 1-2 inch tap . . . . .	.75	One 6 inch wooden plug . . . . .	.50
Thirty-four lbs. Knowlton packing	34.00	One 3 in. x 2 in. iron tee . . . . .	.15
One ratchet drill	2.00	Three hand hole plates . .	3.00
Four drills	2.00	Two check valves	10.00
One hand brush . . . . .	.50	One 2 1-2 iron tee . . . .	.15
One valve wrench . . . . .	.50	One 3 inch iron coupling . . . . .	.15
Two fire shovels	1.50	One 3 in. x 2 1-2 in. iron tee . . . . .	.15
One scythe . . . . .	.50	Eight pieces pipe covering	2.00
Three files . . . . .	.50	Thirty-six sleeves for W. I. pipe	72.00
One copper hammer . . . . .	.50	Six ft. 10 in. x 4 in. soil pipe	1.00
One 2 ft. steel square	1.00	Thirty feet 4 inch wrought iron pipe . .	7.50
Half gal. Solarine polish . . . . .	.35	Five 4 inch elbows	7.50
One 5 gal. oil can . . . . .	.50	Two hundred ft. 5 ft. fence pickets	5.00
One set spring and packing for small pump	5.00	One gate frame and cover	1.00
One round pointed shovel	1.00	One bit stock and bits . .	1.50
Nine lamp chimneys	1.00	One claw hammer . . . . .	.75
Three lantern globes . . . . .	.30	One pair 3 in. clamps . .	.50
Seventy-five fire bricks	1.50		
Twelve lbs. 1-2 inch tucke packing	6.00		
Six pieces 2 1-2 inch steel pipe	5.00		

Three steel wedges...	3.00	Three boilers	3,000.00
Two pair 6 in. wooden clamps	1.00	One post hydrant wrench .....	.50
One long handle scoop	1.00	One sidewalk wrench	1.00
Two garden hoes....	2.00	Half bbl. magnesia..	
Two iron rakes.....	1.00	pipe covering.....	.50
One old 2 inch valve.	1.50	One caulking hammer	1.00
One old bench vise...	1.00	One machinist's hammer.	1.00
One 6 in. iron nipple.	1.00	Fifty ft. 3-4 in. rubber hose.	5.00
One old steam trap...	2.00	Two 4 in. 1-4 bends..	2.50
Two pipe hangers ...	.50	Fifty-three feet 6 inch wrought iron pipe..	25.00
Two air pumps.....	300.00	Thirty feet 4 inch wrought iron pipe..	5.00
One condenser and pumps.....	200.00		
Half bbl. Cumberland coal.....	.50		

Property and Tools at Pumping Station No. 3.

Two three million gal. Worthington pumps	2,000.00	One 8 inch monkey wrench.....	.40
One air pump	100.00	Four Stillson wrenches.....	2.00
One boiler feed pump	100.00	Eight socket wrenches	4.00
Two boilers	1,500.00	Three offset wrenches	5.00
Five wrenches for Worthington pump	5.00	Four 3-4 in. eye bolts.	1.00
One 18 inch monkey wrench.....	.75	Three 1-2 in. eye bolts	.75
One 12 inch monkey wrench.....	.50	Two brooms.....	1.00
		Two brass trays	2.00
		Three brass oil cans..	1.50

Three tunnels.	50	One waste can	50
Twenty-two 6 in. rubber valves.	10.00	One mop	.25
One dust pan	.25	Two lbs. cotton waste.	.50
One brush	.50	Two 5 gal. oil cans.	1.00
Six 4 inch springs	.50	One iron rake	.50
One 4 foot ladder	1.50	One line	1.00
One stand	2.00	One 24 in. discharge	1.50
One 9 foot running board.	3.00	One 2 inch scraper	1.00
Eight 30 lb. m. rubber hose	.25	One faucet	1.25
One work bench	2.00	One hook	2.00
One platform scales	15.00	Two axes	1.00
One iron wheelbarrow	2.00	One coal hammer	.50
Two coal shovels	2.00	One pipe, use and bench	2.50
One sledge hammer	1.50	Eight 5 inch rubber valves	8.00
One slice bar	1.00	Five brass valve springs	.75
Two boiler books	2.00	Twenty-five ft. 1-1-2 in. rubber hose	5.00
One hook bar	1.00	One ink stand	.25
Two pails	.50	Three lamp chimneys	.45
Six drip pans	2.00	One lantern globe	.10
Four brass oil cans	2.00	Five 1-2 lbs. Knowlton packing	5.50
Four brass trays	2.00	Two lbs. flax packing	1.00
Ten gals. kerosene	1.00	Three 1 lbs. Eureka packing	1.50
One 1-2 gal. oil can	.25	One diaphragm for hand pump	.50
Three B. & H. lamps	7.50	One hand hole gasket	.25
Two large lamps	5.00		
Three bracket lamps	1.50		
Three lanterns	1.00		
Two 60 gal. oil tanks	6.00		

One post hydrant wrench.....	.50	Two 1 inch iron unions.....	.50
Two fork wrenches..	2.00	Two 2 inch iron nipples.....	.20
One gate wrench....	2.00	One 1 in. x 3 1-4 in. iron tee. ....	.20
Forty gals. cylinder oil.....	16.00	Two 1 1-2 in. flanges.	1.00
One qt. Solarine polish	.25	Three 2 in. brass valves.....	12.00
Two pipe cutters ..	3.00	Two picks.....	1.00
One 2 in. die stock and die	3.00	Two round pointed shovels.....	2.00
One machinist's hammer.....	1.00	One long handle scoop	1.50
One long steel chisel	1.50	Two fire bars	2.00
One 1 1-2 inch die.	1.00	One hand saw .....	.50
One 1 1-4 inch die	1.00	One cold chisel .....	.50
One 2 inch die	1.50	Twelve ft. 3-5 in. rubber hose .....	.50
Three 2 in. couplings	.50	One spur wheel	1.00
Three 2 in. end wrenches	.50	Two window sashes ..	1.00
Two 1 in. end wrenches	.50	Three 2 inch flange nuts.....	1.50
One 1 1-4 in. end wrench	.50		

Equipment and Tools at Pumping Station No. 4.

Two 16 inch pumps.....	500.00	One motor	50.00
Two 12 inch pumps	400.00	Two tanks	5.00
One centrifugal pump	200.00	One air pump .....	.25
One 10 inch pump	100.00	Four chairs	5.00
One 8 inch pump	50.00	One small pump .....	.25
One 6 inch pump	30.00	Three autotoms.....	1.00

One whisk broom . . .	.10	Three cold chisels. . .	1.50
One gate plan	1.00	Eleven ratchet wren-	
Two clocks	5.00	ches.	15.00
Five large lamp wicks	.50	Four S wrenches. . .	2.00
Eighteen small lamp		Two spanners.	1.00
wicks . . . . .	.25	One 24 inch Stillson	
Eighteen 10 in. x 3-4		wrench.	1.50
in. gauge glasses. . .	2.50	One 36 inch Stillson	
One 26 in. x 3-4 in.		wrench	2.00
gauge glass. . . . .	.50	One 18 inch Stillson	
Two 18 in. x 3-4 in.		wrench	1.00
gauge glasses . . . . .	.75	Two 12 inch Stillson	
Twelve 3-4 in. rubber		wrenches	1.00
washers. . . . .	.50	Two 12 inch monkey	
One bull's eye glass	.50	wrenches	1.00
Twelve large lamp		One 24 inch monkey	
chimneys	2.00	wrench	1.50
Four small lamp chim-		One 8 inch Stillson	
neys . . . . .	.40	wrench. . . . .	.50
Four sheets emery		Three pair chain tongs	9.00
cloth. . . . .	.08	Two pair pipe tongs..	3.00
Two 2 in. valve discs	.20	One screw jack.	2.50
Eight 1 1-4 inch valve		One scythe . . . . .	.50
discs . . . . .	.80	One scotch drill.	3.00
Three 1 in. valve discs	.30	One ratchet drill. . .	2.00
One 3-4 in. fusible plug	1.00	One 2 inch die stock	
Twenty gals. kerosene	2.00	and die.	15.00
Forty gals. cylinder		One Armstrong stock	
oil	16.00	and dies.	20.00
Two gals. engine oil..	.50	One small die stock	
Two 60 gal. oil tanks	3.00	and set of dies . . .	5.00

Two pipe cutters....	2.00	Seven lbs. 5-8 inch	
One pipe bench and vise	5.00	Chesterton packing	3.50
Two anvils	5.00	Six lbs. 1-2 in. Chesterton packing.....	3.00
One blacksmith's forge	10.00	Seven lbs. 3-8 inch Chesterton packing	3.00
Two drills....	.50	Thirty - seven lbs. Knowlton packing.	37.00
Two files.....	.25	Two lbs. oxalic acid..	.20
Twenty-four pump wrenches	25.00	Fifteen lbs. Black Hawk sheet packing	7.50
Ten packing tools....	2.00	Five lbs. sheet rubber packing	2.50
Fifteen eye bolts	10.00	Six studs for plates ..	1.00
One screw driver....	.25	Half gal. Chesterton polish .....	.50
One oil set with stand	2.00	Two discs for 3 inch P. & C. valves....	.50
Two machinist's hammers	2.00	Two balls asbestos packing.....	.50
Two oil cans.....	.50	Four rubber valves for pumps.....	4.00
One saw.....	.50	Two hundred pump springs.....	20.00
One dust pan .....	.50	Four lbs. 7-8 in. square packing.....	2.00
One mop .....	.50	Two balls lamp wicking.....	.20
One lever for feed pump	2.00	Seventy-five old pump valves.....	5.00
One floor brush	1.00	One gauge glass cutter	.50
Twelve lbs. cotton waste .....	.60		
Three valve studs and nuts for large pump	3.00		
Ten rubber valves for condenser	10.00		
Two lbs. Daniels packing.....	1.00		

One spirit level.....	1.00	One ground hoe.....	1.00
Two gate wrenches..	4.00	One iron coal barrow.	2.00
Three-quarters bbl. ce- ment	1.00	One coal hammer....	1.00
Seven fire irons.....	7.00	One 20 ft. Howe plat- form scales.....	100.00
Two boats... ..	10.00	One small platform scales	5.00
Two coal scoops.....	2.00	Two dippers .....	.20
One grind stone.....	5.00	One 20 ft. ladder....	4.00
One snath... ..	.50	Two trowels....	1.50
One 3 inch. tube scraper... ..	2.00	Two shaking levers for grates	2.00
One blow out hose...	5.00		

Property and Tools in Stock Room.

Twenty-eight hundred lbs. pig lead.....	12.50	One hundred lbs. rub- berbestos sheet packing	50.00
Nine hundred twenty- seven lbs. yarn....	37.00	Sixty-five lbs. sheet rubber packing....	32.50
Three hundred lbs. cotton waste	19.50	Six ft. 2 in. lead pipe..	3.00
Three hundred seven- ty-five lbs. wiping solder	75.00	Four gals. wood filler	3.00
One hundred fifteen lbs. soft solder	23.00	Two electric clocks..	10.00
Seventy-five lbs. old lead	3.00	One gauge for reser- voir.	100.00
Thirty-five lanterns..	15.50	Five lbs. lamp black..	.50
Twenty-eight lantern globes	2.80	Two lbs. sizing.....	.20
One bull's eye lantern	1.00	One 8 inch cog gear.	5.00
		Ten lbs. raw umber..	1.00
		One can chrome green	.50
		Two lbs. harness dressing.	1.00

One qt. axle oil . . . . .	.15	Six castings for 1 in.	
Nine gals. Chesterton		plugs. . . . .	.50
polish	4.50	Eight hundred lbs.	
Four lbs. french yellow	1.00	coke	2.00
One can varnish	1.50	Twenty-nine round	
One qt. white liquid		pointed shovels . . .	29.00
dressing . . . . .	.50	Five snow shovels . .	5.00
One 1 gal. oil can . . . .	.20	Two coal scoops	2.00
One lb. bronze . . . . .	.50	Four iron rakes	3.00
Five spirit levels	5.00	Three paving ham-	
Fourteen caulking		mers	4.50
hammers	14.00	Three stone hammers	9.00
Seven Lowell Water		Three hatchets	3.00
Works stamps	3.50	Four saws	3.00
One door check and		Ten monkey wrenches	7.00
spring . . . . .	.50	Eighteen cold chisels	10.00
Fifteen lead paper		Three paver's brooms	1.50
weights	1.50	Four 5 gal. oil cans . .	1.50
Two 1 3-4 inch nuts . . . .	.25	Nine yarning irons . . .	9.00
Two iron wedges	2.00	One wire brush	1.00
Two reservoir gate		One pinch bar	1.50
spindles	10.00	One 30 in., 2 24 in., 1	
Six keys for sidewalk		20 in., 1 16 in., 2 12	
boxes . . . . .	.60	in., 2 10 in., 4 8 in.,	
Two electric batteries		4 6 in. clips	50.00
and wires	10.00	Eleven stone points . .	11.00
Twenty-five lbs. cop-		Twelve pick handles . .	1.00
per wire	6.50	Five sledge hammer	
One 2 inch auger	2.00	handles . . . . .	.50
Eleven 1-4 inch iron		Twelve striking ham-	
plugs . . . . .	.50	mer handles	1.00

Three caulking hammer handles .....	.30	Eleven clamps for clips	5.50
Twelve striking hammers	15.00	Two bull points	2.00
Five sledge hammers	6.25	One 12 inch cog gear	5.00
Twelve wooden mauls	12.00	Ten lbs. mop waste .....	.50
Two axes	2.00	Four asbestos elbows	2.00
One carpenter's adze	1.50	One gal. Solarine polish	1.50
Ten flush hydrant wrenches	20.00	One grass hook .....	.50
Seven post hydrant wrenches	3.50	One handle for hand pump .....	.50
Two gate wrenches	6.00	Twenty-four 1-2 lbs. Knowlton packing	25.00
One tunnel .....	.25	Fifteen 1-2 lbs. rubber-bestos gasket tubing	7.75
Two rock wedges	2.00	Three 1-2 lbs. Eclipse gasket tubing	1.75
Three bursting wedges	3.00	Eleven lbs. 1 inch braided hemp	3.00
Forty caulking sets	20.00	Eleven 1-2 lbs. 7-8 in. square packing	8.50
Twenty-six diamond points	20.00	Forty-six lbs. gum core packing	23.00
Two spanners	1.00	One 2 inch Kennidy valve	8.00
Ten cutters	10.00	Two 1 1-2 in. Kennidy valve	11.00
Fourteen pipe wedges	7.00	Six 1 inch Kennidy valve	16.50
Seven 4 inch hose washers .....	.50	One 1 1-4 in. Kennidy valve	5.00
Seven small drills	5.00		
Twenty-four shims	2.00		
Twelve wedges	1.00		
One ratchet handle	1.00		
One jaw for 18 inch Stillson wrench .....	.50		

Three 2 inch valves..	15.00	One 6 in. pipe cutter.	10.00
Two 1 inch valves...	5.00	Three wrought iron	
Two 3-4 inch valves.	3.50	pipe cutters.....	7.50
One 6 in. Kennidy		Four ratchet die	
valve	10.00	stocks.....	40.00
Eleven 1-4 inch Ken-		Three lawn mowers..	15.00
nidy valves.....	5.00	One 6 inch tapping	
One 2 1-2 inch valve.	7.50	machine	400.00
Six 2 inch Pratt &		One 2 in. globe valve	5.00
Cady valves.....	18.00	Two 1 1-2 inch globe	
Five 3-4 in. compress-		valves.....	7.00
sion cocks	7.50	Four scythes.....	2.00
One iron spring weight	1.00	Two snaths	2.00
Eighty-five 3-4 in. iron		Six wooden rakes....	6.00
washers	1.00	Two long handle coal	
One railroad jack ..	3.00	scoops.....	2.00
Two hoisting jacks ..	8.00	One sod cutter	1.00
Six lights of glass...	.50	Eight pair rubber	
Fifty lbs. plumbago..	5.00	boots.....	24.00
One top for Marine		Eight 5-8 inch goose	
pump	2.50	necks	4.00
Three chain tongs ...	25.00	Eleven 3-4 inch goose	
Six ft. pipe covering.	.50	necks	6.00
Twenty ft. fountain		Four 1 in. goose necks	5.00
chain	2.00	Three 3 inch iron well	
Fifty lbs. tallow	5.00	points.....	9.00
Fifteen pair pipe tongs	100.00	Three Marine pumps.	45.00
Three Stillson wren-		Eleven lengths 4 inch	
ches	3.00	rubber hose.....	100.00
Thirteen die stocks ..	100.00	One 4 inch galvanized	
Fifty assorted dies...	50.00	iron pump.....	5.00

Five pitcher pumps..	35.00	Twenty 5 in. x 1 in.	
Fifteen lbs. leather ..	3.00	iron bolts	1.00
Three brass force		One 4 inch flange off-	
pumps	6.00	set . . . . .	.50
Two portions of shaft		Seven 1 in. iron plugs	.35
coupling	1.00	Sixteen 3-4 inch iron	
Fifty ft. block tin		plugs . . . . .	.50
tubing	5.00	Fifteen 1-2 inch iron	
One hundred ft. block		plugs . . . . .	.30
tin rod	15.00	Twenty lbs. iron	
Thirty ft. 1-4 in. cop-		spikes	1.00
per wire	3.00	One hundred fifty lbs.	
Eleven 1-2 lbs. 1-16		lead dross	4.00
inch iron wire . . . . .	.60	One 10 inch plug . . .	2.00
Twenty-five ft. 1 inch		One steam gauge . . .	6.00
rubber hose	5.00	One check valve, old.	6.00
One hundred and fifty		Fourteen composition	
ft. 3-4 in. rubber hose	20.00	boxes for Morris en-	
Three brooms	1.50	gine	50.00
Fifty lbs. salt	1.25	Two lamp burners . . .	.50
Six small lamp chim-		Six portions of springs	
neys . . . . .	.60	for engine	2.00
One brass gong	1.00	One steam blow-off . .	3.00
Six 4 in. iron flanges.	.50	One belt for electric	
Two wheels for sliding		motor	15.00
door . . . . .	.20	Four lbs. toilet paper	.20
Seven dippers . . . . .	.70	Five hundred lbs.	
One 4 in. steam valve	5.00	paper for packing . .	65.00
One 6 in. steam valve	8.00	One hand brush . . . .	.50
One hand bar	1.00	Twenty exploders . . .	.40
One wheel for gate . .	.50	Fifty lbs. dualin	11.50

Two 2 3-4 inch belts.	10.00	Three bolts for Marine	
One gas jet tube.....	.50	pump .....	.15
Two para rubber bands	.50	Thirty - s e v e n lag	
Two 1-2 inch gauge		screws	1.50
glasses .....	.20	Sixty-eight 3-4 inch	
Eight 3-4 inch gauge		iron bolts	1.50
glasses	1.00	Eighty-two 1-2 inch	
Seventy-two 1-2 inch		iron bolts.....	1.50
rubber washers....	1.50	Two pipe hangers ...	1.00
Twenty-two 3-4 inch		Fifty-three 3 in. brass	
rubber washers...	.50	screws	2.50
Six Rochester lamp		One repair valve	2.50
wicks .....	.50	Two whitewash brush-	
One electric gong. ..	2.00	es	1.00
Five steel scrapers...	.50	Two 1 1-2 in. carpen-	
Two 10 inch monkey		ter's chisels	3.00
wrenches	1.50	Five jaws for 18 inch	
Two claw hammers,		Stillson wrenches..	1.50
new.....	2.00	Fifteen striking ham-	
Two spring oil cans..	.50	mer handles.....	.75
Eight whetstones....	.75	Fifty lbs. grass seed..	3.00
One 2 in. tube scraper	2.00	Five 6 inch cast iron	
Two 10 inch Stillson		plugs .....	.50
wrenches	1.50	Twenty-two lbs. felt	1.00
Two panel locks.....	1.00	One A. P. Smith lead	
Eleven battery jars...	5.50	furnace.....	60.00
Forty-two 20 in. x 1		One freight truck ...	10.00
in. iron bolts	2.00	One hundred ft. 1 in.	
Two 2 1-2 in. x 1 in.		rope	1.50
brass caps and cocks	10.00	Two cans Keystone	
Three 3 in. key bolts.	.75	grease.	10.00

Ten Keystone oil cups	5.00	On top 5 inch Chap-	
Fifteen tin oil tunnels	1.50	man hydrant . . .	5.00
Fifty gals. lard oil...	15.00	Sixty-one gate spin-	
One spindle for Dean		dles	200.00
pump	15.00	Two 6 inch discs for	
Ten ft. 1 1-2 inch		Boston gate. . . .	5.00
shafting	3.00	One 8 inch disc for	
One 18 in. shaft pul-		Boston gate	2.50
ley	1.50	One 4 inch disc for	
One Barclay lubricator	12.00	Boston gate	2.50
One Lowry hydrant		Twelve castings for	
wrench	1.50	gate spindles, brass	40.00
One 2 in. goose neck.	2.00	Six brass castings for	
One marlin spike....	.50	travelers	3.00
One set hydrant tools	10.00	Twenty three brass	
Two brass heads for		castings for hydrant	
Worthington pumps	30.00	stems	50.00
One set bridge irons..	2.00	T w o independent	
Seventeen hand hole		valve stems	2.00
gaskets	1.00	Thirty-three brass parts	
Two sets 24 inch rods		spindles for hydrants	33.00
and heads for float-		Forty caps for hy-	
ing pipe	5.00	drants	10.00
One top Chapman hy-		Thirty-nine hydrant	
drant	5.00	nipples	39.00
Three hoods Chapman		Two stuffing boxes for	
hydrant	1.50	Boston post hydrant	1.00
Two bbs. Chapman		Six rubber valves for 4	
hydrant	4.00	in. Michigan hydrant	3.00
One top 4 inch Chap-		Five rubber valves for	
man hydrant	5.00	Eddy hydrants . . .	2.50

Fourteen 6 in., 6 4 in. rubber valves for Ludlow hydrants..	10.00	Thirteen sets coupl- ings for 2 1-2 inch hose, old	4.00
Eighty-seven rubber gaskets for hydrants	17.50	1 dry tapping ma- chine and drills ...	5.00
Sixteen rubber gaskets for Lowrey hy- drants	8.00	One 2 inch boring ma- chine	2.00
Ten 6 in., 11 8 in. rub- ber gaskets for Bos- ton post hydrants..	10.50	Thirty bolts for flush hydrants	3.00
Three wastes for Bos- ton post hydrants..	1.50	One packing can	3.00
One waste for Lowrey hydrant .....	.50	Twenty-four assorted spindles for post hy- drants	50.00
One hundred fifty lbs. Norway iron	6.38	Three bolts for hy- drant valves	3.00
Six 1-4 turns for drinking fountains.	4.50	Four iron plates for gates	1.00
Eight tap screws for hydrants	1.00	Two hundred fifty lbs. 4 inch lead pipe...	15.00
Twelve flanges for fountains	3.00	Two hundred lbs. 2 inch lead pipe	12.00
One weight for check valve .....	.50	Seventy-five lbs. sheet lead	4.50
Fifteen lbs. packing for gates	3.00	Two wrenches for gate posts .....	.50
Thirteen wrench nuts for gate spindles...	2.00	Twenty-five handles for cellar cocks...	1.00
One set of tools for fountains	10.00	Forty-six 6 in. x 3-4 in. iron bolts	1.50
		Nine fountain backs..	4.50
		Five fountain bottoms	2.50

Ten dog trough guards	2.50	Forty-three ft. 3-8 inch iron pipe	1.00
Eleven aprons for fountains	5.50	One hundred twenty ft. 1-2 in. brass pipe	10.00
Six dog troughs	3.00	Twenty lbs. pig cop- per	3.60
One 2 in. flange goose neck	2.00	Twenty-three lbs. zinc	1.50
Three 20 in. manhole gaskets	1.00	Sixty-three lbs. block tin	20.00
Fifteen ft. 2 in. brass pipe	1.50	Thirty-six lbs. anti- mony	3.75
Five hundred feet 3-4 inch tin lined pipe.	150.00	Eleven diaphragms for Marine pump	5.50
Four hundred ft. 1 in. tin lined pipe	140.00	Two mop handles . . . . .	.20
Twenty ft. 2 in. lead lined pipe	2.40	Twelve iron mauls	9.00
Two hundred fifty ft. 1 1-2 in. lead lined pipe	37.50	Three sidewalk box cleaners	3.00
Twenty-five ft. 3 inch iron pipe	3.50	One ciapper for Marine pump . . . . .	.50
Sixty ft. 2 in. iron pipe	2.50	One 18 inch monkey wrench	1.50
Sixty ft. 1 1-4 in. iron pipe	2.00	Five hundred lbs. old brass	30.00
Four hundred eighteen ft. 1 in. iron pipe	21.00	Five lbs. blueing . . . . .	.50
Forty-six ft. 1-2 inch iron pipe	2.00	One wrench for jack . . . . .	.50
Fourteen ft. 1-4 inch iron pipe . . . . .	.50	IRON FITTINGS.	
		Fifty-one right and left elbows	2.00
		Seven 2 in. x 1 in. y's	2.90
		Twenty-six 2 inch couplings	3.00

Thirty 1 1-2 in. couplings	3.50	Twelve 1 inch tees	2.00
Ninety-three 1 inch couplings	9.00	Two 3-4 inch tees . . . . .	.25
One hundred twenty-four 3-4 inch couplings	12.00	Two 3-4 in. x 1-2 in. tees . . . . .	.25
Twenty-three 1 1-4 in. couplings	2.50	Four 2 inch elbows	1.00
Fifty-seven 1 in. x 1-2 in. couplings	6.00	Eight 1 1-2 in. elbows	1.50
Five 2 inch unions	3.00	Two 1 1-2 in. x 3-4 in. elbows . . . . .	.40
Four 1 1-2 inch unions	2.00	Sixteen 1 inch elbows	1.30
Thirty-eight 1 inch unions	11.50	Ten 1 inch x 1-2 inch elbows . . . . .	.90
Fifty-two 3-4 inch unions	14.00	Sixty-nine 3-4 inch elbows	3.50
Two 1 1-4 inch unions . . . . .	.80	Twenty-eight 3-4 in. x 1-2 in. elbows	1.50
Five 2 inch plugs . . . . .	.25	Two 2 in. x 1 1-2 in. crosses . . . . .	.60
Fifty-five 1 inch plugs	2.00	Three 2 inch x 1 inch crosses . . . . .	.90
Nine 3-4 inch plugs . . . . .	.30	Four 2 inch x 3-4 inch crosses	1.20
Six 1-2 inch plugs . . . . .	.15	Four 1 1-2 in. x 1 in. crosses	1.20
Seven 2 in. x 1 1-2 in. tees	1.75	One 1 1-4 in. crosses . . . . .	.25
Two 1 1-2 in. x 3-4 in. tees . . . . .	.50	Fourteen 2 in. nipples	2.10
One 1 1-2 inch tees . . . . .	.25	Fourteen 1 1-2 inch nipples	2.00
Twelve 1 inch tees	2.50	Twenty-five 1 inch nipples	2.25
Two 2 in. x 3-4 in. tees . . . . .	.50	Five 3-4 inch nipples . . . . .	.40
Nine 1 1-4 in. x 3-4 in. tees	4.00		

Two 1 1-2 in. x 1 1-4 in. bushings . . . . .	.10	Two 2 inch x 3-4 inch crosses . . . . .	.50
Ten 1 1-2 in. x 1 in. bushings . . . . .	.40	Four 1 1-2 in. x 3-4 in. crosses	1.00
Two 1 1-4 in. x 1 in. bushings . . . . .	.10	Four 1 1-2 inch tees.	1.20
Two 1 1-2 in. x 3-4 in. bushings . . . . .	.10	Two 2 inch x 3-4 inch tees. . . . .	.60
Thirty-nine 1 in. x 3-4 in. bushings	1.25	Four 1 1-2 in. x 1 in. tees	1.20
Eleven 1 in. x 1-2 in. bushings . . . . .	.40	One 1 1-2 in. x 3-4 in. tees. . . . .	.30
Nine 3-4 in. x 1-2 in. bushings . . . . .	.30	One 1 inch x 3-4 inch tees. . . . .	.25
LEAD LINED FITTINGS.		TIN LINED FITTINGS.	
Nine 2 inch unions	5.40	Sixty-one 3-4 in. couplings	7.00
Nine 1 1-2 in. unions	5.00	Forty-two 3-4 in. x 1-2 in. couplings	5.50
Three 2 in. x 1 1-2 in. y's.	1.50	Fourteen 1 inch tees	3.50
Twenty-one 2 inch couplings	4.00	Twelve 3-4 inch tees	2.10
Four 2 in. x 1 1-2 in. couplings . . . . .	.80	Twelve 3-4 in. nipples	2.00
Fourteen 1 1-2 inch couplings	2.50	Twenty-seven 3-4 in. x 1-2 in. elbows	4.00
Twenty-nine 1 inch couplings	4.50	Twenty-five 3-4 inch elbows	5.00
Three 2 in. 1-8 bends . . . . .	.60	Three 2 inch Mueller Corporation cocks.	25.50
Five 1 1-2 1-8 in. bends	1.00	Seven 1 1-2 in. Mueller Corporation cocks.	49.00
Six 2 inch x 1 inch crosses	1.50	Seven 1 1-2 in. Mueller curb cocks	49.00

Five 2 inch Mueller curb cocks.....	42.50	Eighty-five 3-4 in. half unions for iron pipe	12.75
Seven 1 1-2 in. Mueller curb cocks.....	49.00	BRASS CASTINGS.	
Nineteen 3-4 in. h Mueller curb cocks.	19.00	Sixteen brass castings for Morris engine..	25.00
Twenty-seven 1 inch sidewalk cocks...	43.75	Seventy-three 3-4 in. sidewalk plugs....	18.00
Three 3-4 in. sidewalk cocks	3.75	Thirty-two 3-4 inch cellar plugs.....	8.00
Eighteen 1 in. corpora- tion cocks	27.00	Nineteen 1 inch cor- poration plugs	8.00
Seventy-four 3-4 inch corporation cocks..	92.50	Five 1 inch sidewalk plugs.....	2.50
Six 1 in. cellar cocks.	9.00	Thirty-two 3-4 inch cellar cock barrels..	8.00
Fourteen 3-4 in. cellar cocks	17.50	Thirty 3-4 inch side- walk cock barrels..	7.50
Eighteen 1 inch stop and waste unions..	4.50	Six 1 in. corporation cock barrels.....	3.00
Eighty-one 1 in. h solder nipples....	16.20	Thirty-six 3-4 inch x 1-2 inch elbows ...	3.60
One hundred twenty- three 3-4 in. solder nipples.....	18.50	Ninety 3-4 in. nipples	9.00
Five 1 1-4 in. x 1 in. solder nipples....	1.00	One hundred twenty- five 1 inch nipples.	18.50
Four 1 1-2 in. solder nipples....	1.00	Sixty-one 1 in. x 3-4 in. nipples	9.00
Forty-nine 3-4 inch half unions for lead pipe.....	7.50	Thirty-seven 3-4 inch elbows	3.70
		One hundred seven- teen 1 inch smooth tail pieces	6.00

Fifty-nine 1 in. washers.....	3.00	Five 3-4 inch Crown meters	95.00
One hundred seventy-five 3-4 in. washers	5.50	One 5-8 inch Crown meter	12.00
Four valves for Worthington engine ..	20.00	Two 5-8 inch Nash meters	19.00
Three 50 ft. tape lines	10.50	One 3-4 in. Nash meter	13.50
Six 1-2 twist drills...	.90	Nine 3-4 inch Union meters	162.00
One box crayons ....	.10	One 5-8 inch Union meter	12.00
Half box lava tips...	.25	Three 3-4 inch Hersey meters	40.50
One pair cut nippers.	1.25	Two 5-8 inch Hersey meters	19.00
Three 3-4 in. dies, new	3.00	Two 3-4 inch Trident meters	27.00
Three 1 in. dies, new.	3.75	Seven 5-8 in. Trident meters	66.50
Twelve clamps for 3-4 inch hose	1.00	Seven 5-8 in. Lambert meters	66.50
Eleven hack saw blades. ....	.50	Five 3-4 in. Columbia meters	60.00
Eight small files.....	.75	Ten 5-8 in. Columbia meters	80.00
Six 6 inch half round files.....	1.20	One 3 in. Worthington meter	40.00
Nine 12 inch mill files	3.00	Three 2 in. Worthington meters	75.00
Six 12 in. half round files.....	2.00	Three 1 1-2 inch Worthington meters	60.00
Four lbs. sealing wax	.40		
Five belt laceings....	.10		
One thermometer....	.50		
One 2 inch Crown meter.	65.00		
Two 1 1-2 inch Crown meters	112.00		
Six 1 in. Crown meters	162.00		

One 1 in. Worthington meter	12.00	Three bottoms for 3-4 inch Trident meters .....	.75
Thirty-seven covers for 3-4 inch Crown meters	55.50	Twenty-five clocks for Worthington meters	6.25
Five covers for 1 inch Crown meters	8.75	Nine tops and ratchets for Worthington meters	2.00
Twelve covers for 5-8 inch Crown meters.	15.00	Seventy-five sets 3-4 in. meter couplings	30.00
Six covers for 5-8 in. Nash meters	7.50	Forty-four sets 5-8 in. meter couplings...	15.20
Three covers for 3-4 inch Nash meters..	4.50	Six sets 1 inch meter couplings	3.00
Three bottoms for 3-4 in. Empire meters.	4.50	Two doz. Gilbert gauge glass preservers	1.00
Five bottoms for 5-8 inch Trident meters	1.25		

Property and Tools at Boulevard New Wells.

One portable engine and boiler	700.00	Six Stillson wrenches	3.00
One centrifugal pump	200.00	Two pair large pipe tongs	10.00
One force pump.....	35.00	One small chain tongs	3.00
One work bench.....	5.00	Five caulking hammers	5.00
One vise	1.50	Seven large chain tongs	35.00
One 12 inch Stillson wrench.....	.50	Five striking hammers	6.00
Three monkey wrenches	2.00		

One frost hammer . . .	1.50	Seven pairs rubber	
One pipe cutter.	3.00	boots	21.00
Seventeen cold chisels . . .	8.50	One clip.	1.50
Two stone hammers. . .	2.50	Three crowbars.	4.50
One machinist's hammer	1.25	Seventeen lanterns. . .	6.00
Two 2 1-2 inch die		One 5 gal. oil can . . .	.50
stocks and dies . . .	15.00	Four pails	2.00
Two 1 1-2 inch die		Three tag ropes	1.50
stocks and dies . . .	2.50	Twenty-five ft. 1 1-2	
Two 1 inch die stocks . . .	2.00	inch rope . . . . .	.75
Two well starters. . . .	50.00	Three wooden mauls. . .	3.00
Two long toms	200.00	Seven iron mauls . . .	4.75
Six Pitcher pumps. . .	30.00	Eight wheelbarrows. . .	8.00
Three spirit levels. . . .	3.00	One coal scoop	1.00
One small oil can. . . .	.10	Fifty-two shovels. . . .	37.00
One lead furnace. . . .	5.00	Fifty-five picks.	41.25
One lead pot.	2.00	One small tool box. . .	3.00
Three ladders.	3.00	Two large tool boxes. .	10.00
One 24 inch hoisting		Six hundred thirteen	
jack	5.00	lbs. sheet rubber	
Four hand saws. . . .	3.00	packing	105.00
Two derricks complete.	250.00	Nine hundred forty-	
One set iron falls and		four ft. 2 in. x 7 in.	
chain	25.00	x 16 in. lumber. . .	18.00
One set rope falls . . .	15.00	Eight hundred eighty	
One file . . . . .	.30	ft. 2 in. x 9 in. x 16	
Two ditch lines. . . . .	.50	in. lumber	16.00
One axe	1.00	Two thousand three	
Five steel wedges . . .	5.00	hundred thirty-three	
		ft. 4 inch x 4 inch	
		lumber.	42.00

One hundred lbs. red lead	5.00	Five thousand two hundred fifty lbs. coal	15.00
Ten gals. black varnish	3.00	Three tons pig lead	36.00
Ten gals. kerosene oil	1.00	Sixty-six well strain-ers	396.00
One hundred ninety-seven lbs. coke	1.50		

Property at Water Office, City Hall.

Two roll top desks at \$20.00	\$40.00	Twelve cane seat chairs at 3.00	36.00
Two standing desks at 20.00 and 10.00	30.00	Eight swivel desk chairs at 1.50	12.00
One double flat desk at 20.00	20.00	Two high chairs at 1.50	3.00
One 3-place Inspector's desk	15.00	Two stools at 50c....	1.00
One 2-place Inspector's desk	10.00	One step chair .....	.50
Two single desks at 10.00	20.00	One settee.....	1.00
Two oak tables at 15.00	30.00	One bookcase.....	10.00
One typewriting machine and cabinet..	50.00	Two water gauges and clocks.....	50.00
One small table	2.00	Two thermometers...	.50
One vault table	1.50	One clock	6.00
Two swivel upholstered chairs at 5.00	10.00	Two table gas lamps at 1.50	3.00
Six upholstered chairs at 5.00	30.00	Thirty-three framed pictures and plans.	10.00
		Two rugs at 3.00	6.00
		One set street tools, picks and wrenches	3.00

Two earthen cuspidores .....	.50	One hair brush . . .	.50
Six brass cuspidores.	3.00	One clothes brush .	.50
Six waste paper baskets at 50c	3.00	One match safe (galvanized iron) .....	.50
One shovel (historic)	1.00	One fire insurance map of city (old) .	1.00
Two mirrors at 1.25.	2.50	One atlas of city	10.00
One letter copy press	6.00	Five tin boxes . . .	2 50
Two umbrella racks.	1.50	One Standard dictionary	10.00
Twenty ink stands...	2.00	One photograph album	6.00
Two pen racks .....	.25	One revolving book case	10.00
Four book rests	6.00	One card index cabinet	10.00
Set tools—2 screw drivers, pincers, 1 plane, 1 saw, 1 chisel, hammer, wrench	3.00	One oak cabinet	40.00
Three glass mugs ...	.15	One hundred sixteen city meters in use..	908.50
Bootblackening outfit..	.25		

SIZES.	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.	20 in.	24 in.	30 in.	
Length of Pipe	104	27	672	365	160	--	20	31	20	\$12,904 47
Sleeves	5	1	3	5	4	7	3	3	9	349 00
Caps	55	38	54	1	12	2	1	1	--	250 20
Plugs	10	36	34	--	2	1	--	--	--	29 80
Curves, 1-4	--	--	5	5	12	5	--	--	--	260 00
Curves, 1-8	4	12	6	8	2	9	5	4	--	404 80
Curves, 1-16	2	11	5	2	8	7	11	1	2	448 00
Offsetts	--	--	3	--	1	--	--	--	--	19 60
Gates	3	4	5	3	1	--	--	--	--	251 60

SIZES.		4 X 4	6 X 4	6 X 6	8 X 4	8 X 6	8 X 8	10 X 4	10 X 6	10 X 8	10 X 10	12 X 4	12 X 6	12 X 8	12 X 10	12 X 12	16 X 6	16 X 8	16 X 10	16 X 12	20 X 10	20 X 12	24 X 1
Branches	-	11	-	-	3	9	9	21	1	3	10	-	8	12	10	10	5	5	4	6	1	1	\$1,110 80
Crosses	-	6	-	7	18	6	6	18	1	7	7	8	12	13	9	8	10	5	6	6	4	-	1,454 80
Reducers	-	-	1	-	5	9	-	3	3	7	6	2	2	6	9	-	-	4	5	5	-	-	234 20
Smith Gates and Sleeves	-	1	1	2	3	3	-	-	1	1	-	2	1	1	-	-	1	-	-	-	-	-	399 32

3,190 12

\$114 882 78

REAL ESTATE IN WATER WORKS PLANT.

ACRES	SQUARE FEET.		
35 1-2	- - -	Cushing farm and buildings at Boulevard extension -	\$6,000 00
23	1,038,616	with buildings - - - - -	21,705 48
22.40	974,557	at Pumping Station No. 4, Boulevard - - -	10,150 00
5.34	232,966	at Filter Gallery - - - - -	4,391 57
4.80	187,932	at Conduit and Tunnel - - - - -	30,455 37
6.78	295,757	at Pipe Conduit - - - - -	15,067 99
1.17	51,101	at Pumping Station No. 1 and yard, Hampshire, W. Sixth	12,327 25
0.19	8,113	at Superintendent's residence, West Sixth street -	2,286 20
14.96	651,600	Low Service Reservoir, Beacon street - - -	28,865 21
2.00	54,730	High Service Reservoir, Tenth street, in Lowell -	2,500 00
	32,470	High Service Reservoir, Tenth street, in Dracut -	
2.98	64,251	over Delivery Pipe - - - - -	3,180 70
38.67	1,684,930	at Pumping Station No. 2, Plain and Chelmsford streets	25,497 00
35.15	1,531,109	at Pumping Station No. 3, in Chelmsford - - -	3,300 44
2.65	115,646	at Pumping Station No. 3, in Lowell - - -	500 00
		dwelling house, at reservoir - - - - -	1,200 00
		Pumping Station No. 1, West Sixth street - - -	97,000 00
		Stable and Shop, Hampshire street - - - - -	17,000 00
		Storehouse and Shed - - - - -	2,000 00
		Pumping Station No. 2, Chelmsford and Plain - - -	2,000 00
		Pumping Station No. 3, in Chelmsford - - -	1,000 00
		Pumping Station No. 4, at Boulevard - - -	6,000 00
		Superintendent's house, West Sixth street - - -	1,800 00
		"Cook Plant" (P. S. No. 2.) Wells, Mains, &c - - -	25,000 00
		"Hydraulic Plant" (P. S. No. 3.) Wells, Mains, &c - - -	59,247 00
		"Boulevard Plant" (P. S. No. 4.) Wells, Mains, &c - - -	66,577 65

<div> <div>Inlet Chamber</div> <div> <div>Gate houses</div> <div> <div>Terminal Chamber</div> <div>Reservoir Chamber</div> </div> </div> </div>		\$	7,243 13
Brick Conduit and Tunnel, cost.....			185,058 71
Filter Gallery			120,812 42
Twenty four inch pipe in Gallery			5,349 97
Filter Basin.....			20,725 26
Sixteen inch gate at Chamber			50 00
Gate House at Beaver Brook..			150 00
Reservoir and connection, Low Service...			99,935 04
Reservoir and connection, High Service....			19,159 63
Canal crossings, truss, East Merrimack Street			300 00
Bridge crossings			500 00
River crossings, 30 inch pipe, extra			10,000 00
“ “ 24 inch pipe			9,988 58
“ “ 12 inch pipe			15,512 25
Fences, Walls and Embankments			4,300 00
Roads, Bridges, Culverts, Etc.....			5,500 00
Pipe Conduit lines, 30 inch old line.....			43,929 60
“ “ “ 30 inch new line			28,655 93
“ “ “ 48 inch new in Tunnel section			5,200 00
Force Mains, 24 inch and 30 inch.....			58,884 34
Distribution Main, as per schedule.....			467,449 40
Stop gates and boxes, as per schedule....			27,212 40
Hydrants, as per schedule.....			58,950 00
Services and Boxes.....			208,620 00

Coal on hand January 1, 1901:

P. S., No. 1, 1296	$\frac{56}{2000}$	}	3580	$\frac{742}{2000}$ tons....	12,467 36
P. S., No. 2, 694	$\frac{22}{2000}$				
P. S., No. 3, 292	$\frac{438}{2000}$				
P. S., No. 4, 1298	$\frac{226}{2000}$				
Value new 12 million gals. water supply..					2,400,000 00
Total.....					<hr/> \$4,375,888 67

REPORT OF CITY ENGINEER.

OFFICE OF CITY ENGINEER,

LOWELL, MASS., Jan. 1, 1901.

To the Lowell Water Board:—

GENTLEMEN — I have the honor to submit the Twenty-eight Annual Report for the year ending December 31st, 1900:

PUMPAGE.

Total net Pumpage for 1900	2,884,271,028	Gals.
Total net Pumpage for 1899	2,659,052,210	"
An increase in 1900 of	225,218,818	"

CONSUMPTION.

Consumption for 1900	2,881,074,794	"
Consumption for 1899	2,659,464,909	"
An increase in 1900 of	221,609,885	"
High Service Pumpage for 1900	65,472,694	"
High Service Pumpage for 1899	50,590,456	"
An increase in 1900 of	14,882,238	"

The cost of Low Service Pumpage was Thirteen Dollars and Ninety Cents (\$13.90) per million gallons, a decrease of Eighty-three Cents (\$0.83) per million gallons from the cost of the same in 1899. This decrease is mostly due to the use of the Worthington High Duty Engine for the greater part of the work at Station No. 1.

The cost of pumpage from Low Service to High Service was Ten Dollars and Twenty-one Cents (\$10.21) per million gallons, which added to the cost of Low Service Pumpage, Thirteen Dollars and Ninety Cents (\$13.90) per million gallons, makes the total cost of High Service Pumpage Twenty-four Dollars and Eleven Cents (\$24.11) per million gallons; a decrease of One Dollar (\$1.00) per million gallons from the cost of the same in 1899.

At Station No. 3 no water has been pumped directly into the distributing mains, the quantity pumped there in January, 31,421,136 gallons, having been repumped at Station No. 2. In addition to this quantity it is estimated that 181,100,000 gallons were obtained from the wells at Station No. 3 and pumped at Station No. 2.

The greatest quantity pumped in seven consecutive days during the year was 64,445,484 gallons, which was pumped in the week beginning July 9th and ending July 15th.

The greatest quantity pumped in one day during the year was 9,495,963 gallons, on July 15th.

TABLE SHOWING QUANTITY PUMPED EACH MONTH AT THE SEVERAL STATIONS DURING THE YEAR 1900.

MONTHS.	PUMPING STATIONS — DRIVEN WELLS.				STATION No. 1 — WEST NINTH STREET.				Grand Totals	Net Totals
	No. 2.	No. 3.	No. 4.	Net Totals	Worth'ton High Duty	Worth'ton With'ton Duplex.	Morris.	Totals Low Service Receiving		
January	87,286,976	*31,421,136	148,144,220	225,431,200	140,400,000			140,400,000	3,100,100	980,740,810
February	74,998,720		150,234,630	225,233,350	133,000,000		10,000,000	100,000,000	2,401,812	970,047,800
March	89,314,240		160,210,008	249,525,148	157,100,250		1,070,000	108,741,200	3,100,792	940,000,000
April	88,759,808		163,403,058	252,162,866	142,000,125		1,072,000	153,805,200	2,712,803	950,000,000
May	92,902,016		154,464,804	247,366,820	105,476,025	30,207,100	3,704,400	144,388,200	3,100,100	937,410,371
June	57,686,720		182,325,836	240,512,556	182,350,875			182,350,875	0,701,000	940,007,000
July	75,964,992		198,043,404	274,008,396	197,220,375			197,220,375	10,000,000	970,000,000
August	63,054,112		192,581,822	255,635,934	192,020,125			192,020,125	11,300,000	960,000,000
September	58,727,576		185,649,826	244,377,402	186,418,125			186,418,125	11,100,000	940,000,000
October	39,800,000		178,901,892	218,702,756	190,000,000			190,000,000	0,000,000	940,000,000
November	50,961,280		184,944,064	235,905,344	175,501,125			175,501,125	2,000,000	940,000,000
December	62,707,584		188,104,644	250,812,228	190,000,000			190,000,000	2,000,000	940,000,000
Totals	541,204,586	*31,421,136	2,067,560,142	2,929,714,000	1,803,220,750	30,207,100	23,570,200	2,042,000,000	65,471,000	2,900,000,000
In 1900 — 1,900,000,000										
Increase in 1900										

* Pumped at Station No. 2

The following tables showing the performance of the engines at Station No. 1 on West Sixth Street, depth and quantity of water in reservoir, average temperature of air and water, and the average monthly and daily consumption of water, have been calculated and compiled from the records of the Engineer and Gatekeeper.

**TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH DUTY ENGINE FOR
EACH MONTH DURING THE YEAR 1900.**

MONTHS.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. of water pumped into reservoir per total coal consumed.	Duty in lbs. 1 ft. high coal used in pumping only; no deduction for ashes or clinkers.	Duty on total coal consumed; no deduction for ashes or clinkers.
January	-	23-58	743-00	308,540	8.94	164.04	149,460,000	4,821,200	612	84,230,596	83,721,865
February	-	22-36	597-30	354,840	10.07	164.28	133,080,000	5,118,462	628	87,366,082	85,924,060
March	-	23-37	732-00	419,110	9.54	164.08	157,166,250	5,063,870	654	89,488,224	89,488,224
April	-	23-18	699-00	390,275	9.07	163.94	142,603,125	4,753,437	629	86,299,240	85,966,000
May	-	22-18	535-15	291,271	8.76	163.92	105,476,625	4,394,859	625	86,350,706	85,328,000
June	-	23-19	699-30	486,269	11.59	163.79	182,360,875	6,075,362	715	97,762,705	97,532,867
July	-	23-58	743-00	525,945	11.80	163.74	197,229,375	6,362,258	740	102,794,242	102,247,039
August	-	24-00	744-00	512,075	11.47	163.68	192,028,125	6,194,456	769	104,851,904	104,851,904
September	-	23-58	719-00	497,115	11.52	163.92	186,418,125	6,213,937	741	102,178,447	101,296,519
October	-	23-17	698-30	482,482	11.51	163.94	180,930,750	6,031,25	742	101,357,313	101,357,313
November	-	23-36	708-00	468,243	11.02	164.26	175,591,125	5,853,637	680	93,409,767	93,048,213
December	-	23-56	742-00	482,365	10.84	163.40	180,894,375	5,836,302	662	90,232,687	90,232,687
Totals and Averages	355	23-31	8350-45	5,288,910	10.56	163.91	1,983,228,700	6,086,560	687	94,271,109	93,644,283

**TABLE SHOWING WORK DONE WITH WORTHINGTON DUPLEX ENGINE FOR
EACH MONTH DURING THE YEAR 1900.**

MONTHS.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. pumped into tank with per cent. total cost consumed.	Indicate with pump in running daily, in deduction for water consumed in months.	Indicate total cost consumed, in dollars.
January	-	-	-	-	-	-	-	-	-	-	-
February	-	-	-	-	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-	-	-	-	-
April	-	-	-	-	-	-	-	-	-	-	-
May	-	23.47	145.00	113,765	10.25	163.80	30,207.150	6,408.264	.003	12.142 1912	62,100.000
June	-	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-	-
Totals and Averages	8	23.47	145.00	113,765	10.25	163.80	30,207.150	6,408.264	.003	12.142 1912	62,100.000

TABLE SHOWING WORK DONE WITH MORRIS ENGINE (BEAM AND FLY WHEEL)
FOR EACH MONTH DURING THE YEAR 1900.

MONTH.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction in feet.	Quantity pumped in month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. of water pumped into reservoir only; no deduction for ashes or clinkers.	Duty in lbs. 1 ft. high coal used in pumping only; no deduction for ashes or clinkers.	Duty on total coal consumed; no deduction for ashes or clinkers.
January	-	-	-	-	-	-	-	-	-	-	-
February	-	13-02	78-15	53,027	11.29	160.74	16,968,640	2,828,107	336	44,983,103	44,983,103
March	-	2-19	9-15	4,922	8.87	161.12	1,575,040	353,760	544	72,978,712	72,978,712
April	-	3-10	9-30	3,944	6.92	160.62	1,262,080	420,693	543	72,632,383	72,632,383
May	-	6-50	17-30	11,764	11.20	161.65	3,764,480	1,254,827	616	82,962,115	82,962,115
June	-	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-	-	-	-	-
Totals and Averages	16	7-09	114-30	73,657	10.72	160.08	23,870,240	1,473,140	381	51,110,400	51,110,400

TABLE SHOWING AMOUNT OF COAL USED FOR WORTH-
INGTON HIGH DUTY ENGINE AT PUMPING STATION
DURING THE YEAR 1900.

MONTHS	COAL CONSUMED.			
	For starting fires, n. lbs.	When pump- ing, n. lbs.	For banking fires, n. lbs.	Total per month, n. lbs.
January - - -	1,500	212,550		214,050
February - - -	2,300	208,540	2,200	212,040
March - - -		*240,101		240,101
April - - -	300	225,767	800	226,067
May - - -	2,000	166,860		168,860
June - - -		254,610	800	255,210
July - - -	1,400	261,825		263,225
August - - -		249,826		249,826
September - -	2,170	249,238		251,408
October - - -		243,891		243,891
November - -	1,000	257,333		258,333
December - -		273,153		273,153
Totals - - -	10,670	2,873,778	2,400	2,886,848

* { 182,188 coal,
82,818 coke.

TABLE SHOWING AMOUNT OF COAL USED FOR WORTH-
INGTON DUPLEX ENGINE AT PUMPING STATION
DURING THE YEAR 1900.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pump- ing, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January - - - -
February - - - -
March - - - - -
April - - - - -
May - - - - -	91,645	600	92,245
June - - - - -
July - - - - -
August - - - - -
September - - -
October - - - -
November - - - -
December - - - -
Totals - - - -	91,645	600	92,245

TABLE SHOWING AMOUNT OF OIL USED FOR MORRIS
ENGINE AT PUMPING STATION DURING
THE YEAR 1901.

MONTHS	OIL CONSUMED			
	GRAVITY TEMPERATURE	WATER TEMPERATURE	WATER TEMPERATURE	WATER TEMPERATURE
January - - - -				
February - - - -		50.55		50.55
March - - - - -		4.26		4.26
April - - - - -		4.37		4.37
May - - - - -		5.13		5.13
June - - - - -				
July - - - - -				
August - - - - -				
September - - - -				
October - - - - -				
November - - - -				
December - - - -				
Totals - - - -		61,870		61,870

**TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH SERVICE ENGINE
FOR EACH MONTH DURING THE YEAR 1900.**

MONTH	No. of days worked	Average revs. per min.	No. of revs. per min.	No. of revs. per min.	Average No. of revs. per min.	Average head, including friction, in feet	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. of water pumped into feeder vats per lb. total coal consumed.	Coal in lbs. used when pumping.
January	14	17.32	230.30	275,612	17.82	60.44	3,150,108	202,514	300	10,499
February	16	15.60	194.30	171,628	18.87	63.44	2,401,812	240,181	300	8,006
March	13	17.06	182.00	225,678	20.00	60.44	3,168,702	287,163	300	10,526
April	9	17.23	128.00	153,716	20.44	60.44	2,712,904	301,420	300	9,042
May	13	18.08	150.30	226,310	18.01	60.44	3,109,180	288,107	300	10,563
June	20	23.30	680.00	679,864	11.65	92.60	6,703,068	231,171	266	22,470
July	31	24.00	744.00	717,470	10.07	92.60	10,043,890	323,046	300	33,475
August	31	24.00	744.00	719,860	18.12	92.60	11,323,000	365,287	300	37,739
September	20	24.00	720.00	700,042	18.45	92.60	11,144,584	371,486	300	37,147
October	16	22.07	354.00	421,730	19.86	83.91	6,904,346	369,022	301	19,604
November	11	18.40	207.00	201,861	16.25	60.44	2,826,064	256,914	300	9,417
December	10	18.48	188.00	200,611	18.57	60.44	2,933,154	293,315	300	9,778
Total and Average	211	21.14	4060.30	4,076,021	17.13	83.82	65,472,004	310,207	300	218,266

**PUMPING STATION NO. 1 AT BETHLEHEM EDGE DUTY
ENGINE—RUNNING EXPENSES FOR THE YEAR 1900.**

Pay of engineers and firemen	\$7,66 27
185 1451-2000 tons of coal Cumberland coal at \$4.75	87 26
306 635-2000 tons of coal Cumberland coal at \$4.75	1,453 25
539 1523-2000 tons of coal Cumberland coal at \$4.75	2,560 25
384 1233-2000 tons of coal Cumberland coal at \$4.75	1,820 00
41 818-2000 tons of coal at \$4.75	386 25
Electric light	25 17
Gas for lighting works	138 04
489.27 gallons of cylinder oil at 1.00—	489 27
151.81 gallons of engine oil at 0.310—	47 06
49.75 pounds of packing at 1.00—	49 75
360.49 pounds of cotton waste at 1.00—	360 49
32 pounds of tallow at 0.045—	1 44
Repairs on engine	12 90
Repairs on boilers	339 35
Tools	4 30
Sundries	56 27
Total	\$12,728 15

Cost of pumping water into reservoir per million gallons, \$6.42

Cost of pumping water one foot high per million gallons, .03 91-100 --

PUMPING STATION NO. 1, WORTHINGTON DUPLEX ENGINE.
—RUNNING EXPENSES FOR THE YEAR 1900.

Pay of engineers and firemen	\$123 31
46 245-2000 tons of coal (Cumberland, 1900), at \$4.17	192 33
Electric light	5 11
Gas for lighting works	2 89
10.41 gallons of cylinder oil at 0.467—	4 86
3.23 gallons of engine oil, at 0.316—	1 02
7.67 pounds of cotton waste, at 0.065	50
Repairs on boilers	7 22
Sundries	1 20
<hr/>	
Total	\$338 44

Cost of pumping water into reservoir per million gallons, \$9.60—

Cost of pumping water one foot high per million gallons, 0.05 86-100—

**PUMPING STATION NO. 1, MODEL ENGINE—RUNNING
EXPENSES FOR THE YEAR 1909**

Pay of engineers and firemen	\$1, 25
22 250-2000 tons of coal (underground) at \$3.50	77 00
5 250-2000 tons of coal (underground) at \$3.50	17 50
Electric light	2 56
Gas for lighting works	5
5.20 gallons of cylinder oil at 1.50—	7 80
1.61 gallons of engine oil at 1.50—	2 41
16 pounds of packing at 1.50	2 40
3 63 pounds of cotton waste at 0.065	24
Repairs on engine	84 41
Repairs on boilers	3 01
Sundries	20
Total	\$277 04

Cost of pumping water into reservoir per million gallons, \$11.70

Cost of pumping water one foot high per million gallons, 0.07 32.100

RESERVOIR, BEACON STREET, 1900.

MONTHS.	Depth in Feet.	Quantity in U. S. Gallons.	Temperature in Degrees	
			Of Water.	Of Air.
January - - - - -	18.81	28,518,737	39.19	27.37
February - - - - -	19.52	29,712,500	38.64	27.00
March - - - - -	19.55	29,750,325	38.87	31.61
April - - - - -	19.57	29,783,947	43.58	47.92
May - - - - -	19.53	29,723,708	46.31	55.44
June - - - - -	19.16	29,101,771	49.02	70.78
July - - - - -	17.76	26,774,752	60.39	75.90
August - - - - -	19.25	29,252,449	65.47	72.41
September - - - - -	19.48	29,639,686	66.65	65.68
October - - - - -	19.62	29,877,873	64.05	55.41
November - - - - -	18.12	27,366,919	55.07	43.06
December - - - - -	19.02	28,862,139	46.00	31.26

TABLE SHOWING THE AVERAGE MONTHLY AND DAILY CONSUMPTION OF WATER FOR THE YEAR 1900.

MONTH	GALLONS PER MONTH	GALLONS PER DAY
January	221,248,082	7,332,228
February	211,377,722	6,980,440
March	248,747,332	8,024,113
April	229,979,635	7,483,552
May	229,772,341	7,380,077
June	241,139,786	7,778,688
July	296,579,397	9,567,110
August	256,824,815	8,284,656
September	244,165,072	7,876,323
October	228,973,219	7,386,237
November	218,789,913	7,057,741
December	243,180,846	7,844,543
Totals and averages .	2,881,074,794	7,893,356

SUMMARY OF STATISTICS.

REPORT OF 1900.

In accordance with the recommendations of the New England Water Works Association.

LOWELL WATER WORKS, MIDDLESEX COUNTY, MASS.

Population by census of 1900, 94,969.

Date of construction, 1870 to 1873.

Date of construction, High Service, 1881.

Date of construction, Driven Wells, 1893 to 1901.

Source of supply — two hundred twenty (220) driven wells in the valley of River Meadow Brook, and two hundred twenty-one (221) driven wells at Pawtucket Boulevard.

Mode of supply, pumping to reservoir and pumping direct.

PUMPING.

1. Builders of pumping machinery:

AT STATION No. 1.

One engine, capacity 5,000,000 gals. in 24 hours.
Henry G. Morris.

One engine, capacity 5,000,000 gals. in 24 hours,
Henry R. Worthington.

One engine, capacity 10,000,000 gals. in 24 hours,
Henry R. Worthington.

One engine, capacity 500,000 gals. in 24 hours,
Henry R. Worthington.

AT STATION NO. 2 TEMPORARY PUMPS.

One engine, capacity 3,000,000 gals. in 24 hours.

The Dean Steam Pump Co.

One engine, capacity 3,000,000 gals. in 24 hours.

The Dean Steam Pump Co.

AT STATION NO. 3 TEMPORARY PUMPS.

One engine, capacity 3,000,000 gals. in 24 hours.

Henry R. Worthington.

One engine, capacity 3,000,000 gals. in 24 hours.

Henry R. Worthington.

AT STATION NO. 4 TEMPORARY PUMPS.

One engine, capacity 3,000,000 gals. in 24 hours.

Knowles Steam Pump Works.

One engine, capacity 3,000,000 gals. in 24 hours.

Knowles Steam Pump Works.

2. Description of coal used:

(b) Kind, bituminous.

(c) Size, broken.

(d) Brand, Cumberland.

(e) Price per gross ton delivered, \$4.60 . . .

3. Coal consumed for the year, in pounds, 10,684,601
(2,982,990, Station No. 1.)

4. Wood consumed for the year, in pounds.

_____ = coal in lbs. 2,400, Station No. 1.

3

5. Total fuel consumed for the year in pounds, 2,985,300,
Station No. 1.

6. Total pumpage for the year, in gallons, 2,884,271.028.
(2,042,066,140, Station No. 1.)
7. Average static head against which pumps work, 156.14.
Station No. 1.
8. Average dynamic head against which pumps work,
163.98, Station No. 1.
9. Number of gallons pumped per pound of coal, 275.
(685, Station No. 1.)
10. Duty in foot pounds per 100 pounds of coal, using
the following formula, making no deduction for
starting or banking fires, or heating building:—

$$\text{Duty} = \frac{\text{Gallons pumped (6)} \times 8.34 \text{ (lbs.)} \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}} = 83,489,048, \text{ Station No. 1.}$$

COST OF PUMPING FIGURED ON PUMPING STATION EXPENSES OF
\$13,344.53, STATION NO. 1.

11. Per million gallons raised against average dynamic
head (8) into reservoir, \$6.53 —, Station No. 1.
12. Per million gallons raised one foot high (dynamic),
\$0.03 99-100.

Analyses of water from the driven well plants,
Merrimack River and Station No. 1, have been made each
month by the State Board of Health, a record of which
is annexed.

Respectfully submitted,

GEORGE BOWERS,

City Engineer.

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Merrimack River.
(PARTS IN 100,000.)

NO.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			NITROGEN AS		Iron.	Oxygen Consumed.	
	Collection	Examination	Turbidity.	Sediment.	Color	Cold.	Hot.	Total	Loss in ignition.	Fixed.	Free.	Total.	In solution.	In suspension.	Nitrates			Nitriles
29,966	Jan. 1900. 16 17	Decided.	Slight.	.15	None.	Faintly Vegetable.	3.90	1.30	2.60	.0086	.0214	.0166	.0048	.22	.0060	.0002	0.8	.40
30,243	Feb. 20 21	Very Slight.	Slight.	.37	None.	Faintly Vegetable.	3.05	1.50	1.55	.0024	.0190	.0166	.0024	.12	.0020	.0001	0.8	.06
30,633	Mar. 20 21	Slight.	Cons.	.32	Very Faintly Unpleasant.	Faintly Unpleasant.	3.05	1.25	1.80	.0010	.0170	.0144	.0028	.15	.0050	.0001	0.5	.48
31,140	Apr. May 30 2	Slight.	Cons.	.28	Faintly Vegetable.	Distinctly Vegetable.	3.15	1.10	2.05	.0008	.0144	.0114	.0030	.00	.0050	.0001	0.6	.44
31,260	May 15 16	Very Slight.	Slight.	.29	Faintly Vegetable.	Distinctly Vegetable.	3.15	1.30	1.85	.0028	.0162	.0142	.0020	.14	.0060	.0002	0.8	.45
31,773	June 19 20	Slight.	Cons.	.24	Faintly Vegetable.	Distinctly Vegetable.	3.00	1.10	1.90	.0034	.0214	.0144	.0070	.13	.0020	.0002	1.0	.43
32,082	July 17 18	Slight.	Slight.	.11	Faintly Unpleasant.	Distinctly Musty.	3.15	0.90	2.25	.0040	.0222	.0154	.0068	.24	.0020	.0002	1.8	.33
32,606	Aug. 22 23	Slight.	Slight.	.10	Faintly Vegetable.	Distinctly Vegetable.	3.50	1.00	2.50	.0028	.0192	.0136	.0056	.27	.0050	.0003	1.3	.34
32,969	Sept. 18 19	Slight.	Slight.	.23	None.	None	3.95	1.05	2.90	.0088	.0200	.0166	.0034	.28	.0020	.0003	1.6	.32
33,422	Oct. 23 25	None.	Cons.	.28	None.	Decidedly Unpleasant.	4.50	1.60	2.90	.0128	.0224	.0166	.0058	.22	.0030	.0002	1.0	.50
33,720	Nov. 20 21	Slight.	Slight.	.45	Distinctly Vegetable.	Distinctly Vegetable.	4.20	1.60	2.60	.0088	.0240	.0184	.0056	.25	.0050	.0001	1.3	.71
34,136	Dec. 18 19	Very Slight.	Very Slight.	.40	None.	Faintly Vegetable.	4.00	1.50	2.50	.0068	.0188	.0164	.0024	.21	.0120	.0001	1.3	.63

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Pumping Station No. 1.
(PARTS IN 100,000.)

No.	DATE OF ANALYSIS.	APPEARANCE		TASTE.		RESIDUE ON EVAPORATION.		AMMONIA.		NITROGEN AS NITRATES.		Iron.	Oxygen Consumed.
		Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Free.	In solution.	Chlorine.	Nitrate.		
							100 lb. water.	100 lb. water.	100 lb. water.	100 lb. water.	100 lb. water.		
29,559	Jan. 16-17	Very slight.	Slight.	.06	None.	None.	4.30	—	.0032	.31	.0470	.0001	1.7 .0240 .08
29,560	Feb. 20-21	Very slight.	None.	.07	None.	None.	4.40	—	.0034	.31	.0240	.0000	2.0 .0350 .00
29,561	Mar. 20-21	Very slight.	Very slight.	.06	None.	None.	4.20	—	.0036	.29	.0210	.0001	2.0 .0380 .10
31,143	Apr. May 30-2	Very slight.	Very slight.	.08	None.	None.	4.20	—	.0074	.20	.0310	.0001	1.6 .0400 .11
31,263	May 15-16	Very slight.	Very slight.	.10	None.	None.	4.30	—	.0082	.24	.0320	.0000	1.8 .0400 .10
31,776	June 19-20	Slight.	Slight.	.05	None.	None.	4.00	—	.0058	.21	.0320	.0002	1.7 .0320 .10
32,053	July 17-18	Very slight.	Very slight.	.07	None.	None.	4.20	—	.0052	.26	.0180	.0002	1.4 .0160 .00
32,899	Aug. 22-23	Slight.	Slight from.	.10	None.	None.	4.00	—	.0070	.29	.0100	.0003	1.7 .0320 .10
33,030	Sept. 20-22	Slight.	Slight from.	.11	None.	None.	4.90	—	.0054	.20	.0120	.0003	2.1 .0000 .10
33,425	Oct. 23-25	Very slight.	Slight.	.12	None.	None.	4.10	—	.0054	.30	.0130	.0003	1.6 .0150 .07
33,723	Nov. 20-20	Slight.	Very slight.	.06	None.	None.	4.70	—	.0056	.29	.0170	.0002	2.0 .0300 .07
34,130	Dec. 18-10	None.	Slight.	.08	None.	Faintly Vegetable.	5.00	—	.0056	.20	.0460	.0001	2.3 .0400 .10

29th ANNUAL REPORT of the
LOWELL WATER BOARD

Lowell, Mass.



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COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Pumping Station No. 1.
(PARTS IN 100,000.)

(PARTS IN 100,000.)																					
No.	DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA:			Chlorine.	NITROGEN AS		Hardness.	Iron.	Oxygen Consumed.			
	Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on evap'n.	Fixed.	Free.	Alumina:									
												Total.		In suspension.							
29,359	Jan., 1900.	16	17	Very Slight.	Slight.	.06	None.	None.	4.50	-	-	.0060	.0032	-	-	.31	.0450	.0001	1.7	.0240	.08
30,246	Feb.	20	21	Very Slight.	None.	.07	None.	None.	4.40	-	-	.0066	.0034	-	-	.31	.0240	.0000	2.0	.0350	.09
30,640	Mar.	20	21	Very Slight.	Very Slight.	.06	None.	None.	4.20	-	-	.0058	.0036	-	-	.29	.0210	.0001	2.0	.0380	.10
31,143	Apr. May.	30	2	Very Slight.	Very Slight.	.08	None.	None.	4.20	-	-	.0074	.0036	-	-	.20	.0310	.0001	1.6	.0400	.11
31,203	May.	15	16	Very Slight.	Very Slight.	.10	None.	None.	4.30	-	-	.0082	.0026	-	-	.24	.0320	.0000	1.8	.0400	.10
31,776	June.	19	20	Slight.	Slight.	.05	None.	None.	4.00	-	-	.0060	.0058	-	-	.21	.0320	.0002	1.7	.0320	.10
32,033	July.	17	18	Very Slight.	Very slight.	.07	None.	None.	4.20	-	-	.0060	.0034	-	-	.20	.0310	.0001	1.6	.0400	.11



29th ANNUAL REPORT of the LOWELL WATER BOARD

Lowell, Mass.



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TWENTY-NINTH
ANNUAL REPORT
OF THE
LOWELL WATER BOARD
TO THE
City Council of the City of Lowell, Mass.

AND THE
Reports of the Superintendent of Water Works and of
the City Engineer to the Water Board for 1901.

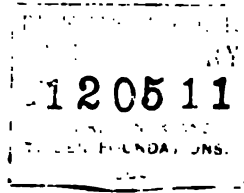


LOWELL, MASS.:
BUTTERFIELD PRINTING CO.
1902

DUP. EXCH. 19 JULY 1902

AM. SOC. OF ENG.

FORD COLLIN



CITY OF LOWELL.

IN BOARD OF ALDERMEN,
February 4, 1902.

Received and ordered on file. Sent down for
concurrence.

GIRARD P. DADMAN,
City Clerk.

IN COMMON COUNCIL.

Received and ordered on file, in concurrence.

FRANK M. DOWLING,
Clerk.

WATER DEPARTMENT, 1901.

WATER BOARD.

FRANK L. WEAVER, President.

Term expires second Monday in March, 1904.

MICHAEL J. DOWD,

Term expires second Monday in March, 1905.

AUGUST FELS,

Term expires second Monday in March, 1902.

HERBERT C. TAFT,

Term expires second Monday in March, 1903.

J. W. CRAWFORD, Secretary and Clerk.

ROBERT J. THOMAS, Superintendent.

GEORGE BOWERS, City Engineer.

D. B. H. BARTLETT, Engineer.

WILLIAM JOYCE, Assistant Foreman.

THOMAS McLOUGHLIN, Engineer.

JOHN E. LOWNY, Meter Inspector.

JOHN B. HENRY, Keeper Reservoir.

ALBERT HALLOWELL, Foreman Shop.

THOMAS F. DOYLE, Foreman.

A. F. COGER, Hydrants and Gates.

THOMAS ROGERS, Services.

OFFICE.

GEORGE E. WORTHEN, Service Clerk. GERTRUDE W. BYAM, Bookkeeper.

JULIA A. RAFTER, Assistant Bookkeeper.

INSPECTORS.

ROBERT GARDNER.

MICHAEL H. McCUE.

FREDERICK A. BARON.

GEORGE F. TILTON.

WALLER P. WILEY.

REPORT OF THE WATER BOARD.

OFFICE OF THE WATER BOARD, }
CITY HALL, }
LOWELL, MASS., Jan. 1, 1902. }

*To His Honor the Mayor and the City Council of the
City of Lowell:*

Herewith is presented the twenty-ninth annual report of the Water Board, for the year ending December 31, 1901, together with the Superintendent's report to this Board, of the operation and statistics of the department for the same period of time.

In accordance with the sentiments expressed in our last report regarding the necessity of restricting the waste of water by the use of meters, the Board passed the following vote, "That in the opinion of the Water Board it is absolutely necessary to check the present gross and extravagant waste of water, and for this purpose the policy of metering all the services of the city should be inaugurated, and the Superintendent of Water

Works is hereby directed to immediately put in as many meters as possible, under the direction of the Water Board." To carry out the provisions of this resolution, a requisition was sent March 4th to the Supply Department for five hundred meters, and they were set as fast as possible on places where there were three or more tenements.

They were all set so as to begin the water year from April 1st, the date when the annual schedule rate expires. The result was as expected. It shows that out of 425 meters set, 189 were using water at less than the faucet rate and 236 were using more than they were paying for by rate. The total charges by rates for the 425 meters were \$18,132, and the first quarter showed the use of water at the rate of \$35,345 per year, the second quarter at \$24,942 per year, and the third quarter at \$15,589 per year. Below are a few samples of how water is allowed to run to waste, and also how it is remedied when the consumer has to pay for it. It will be seen that in many instances the first quarter shows as large a bill as the yearly rate, but the subsequent bills are decidedly smaller, and in other cases there is no reduction, which shows a gross carelessness and a total lack of a public spirit toward aiding the City to maintain an economic water supply, and even an indifference to personal welfare.

	Annual Rate Charge	Charge First Quarter	Charge Second Quarter	Charge Third Quarter
8 tens.	\$143 00	\$106 56	\$120 84	\$ 93 48
9 "	57 50	437 30	248 58	36 19
16 "	70 00	526 60	426 40	335 40
15 "	107 50	144 12	133 56	206 89
7 "	89 00	382 90	417 80	304 60
20 "	95 50	136 08	117 36	160 80
12 "	51 50	111 24	73 56	11 62
22 "	102 00	186 75	160 44	151 08
17 "	183 50	131 88	98 88	93 48
18 "	185 00	219 32	119 04	80 76
15 "	201 00	162 12	87 24	22 82
10 "	174 50	126 48	83 28	31 28
15 "	208 00	63 36	63 24	30 99
10 "	104 00	32 94	6 80	35 02
3 "	37 50	3 50	5 88	6 02
3 "	25 00	84	2 38	
3 "	24 00	1 40	2 52	2 10
4 "	48 00	19 04	2 24	7 28
4 "	20 00	28 65	6 58	7 70
5 "	42 50	28 78	3 22	2 24
4 "	34 50	19 18	4 90	3 08

Following up this line of action, 500 more meters were purchased and installed in November and December, which were put on two tenement houses; we shall thus be enabled to detect where water is allowed to run to waste to prevent freezing, although the rest of the year may show a normal consumption. At the places where this latter 500 meters were set the annual rate had been paid, so that no benefit will to the consumer for a small consumption of water until after April next, and then the meter must be purchased to get the benefit.

On April 3rd a contract was awarded to the Ames Engine Co., for a 42 H. P. Engine and to the General Electric Co., for a 25 K. W. Generator to be erected at the Centralville Pumping Station for lighting the station, shop, stable and yard and to furnish power for the shop.

Owing to the decreased consumption of water and the increased supply made available at the Boulevard by the new wells and pump added last year, it became possible to shut down the Cook plant on May 1st and it has not been necessary to take any water from that source since, and it is hoped that with the new station at the Boulevard soon to be ready, there will be no call to take water from this plant for a long time, except in case of accident. During the summer certain individuals living in the part of the city that had been receiving the water from the Cook plant, complained that the water was not so good as formerly, and accordingly they sent in a petition to the Water Board, bearing 127 signatures, asking that the "Cook wells be reopened so that the people using the water therefrom may have an opportunity to test the quality of the same". A copy of the same petition was sent to the City Council with a request that the "City Council take such action in the premises that the Cook Wells may be reopened". This petition was referred to the Lowell Water Board on October 22nd and on November 5th the Water Board sent the following communication to the City Council in answer.

OFFICE OF THE LOWELL WATER BOARD.

Lowell, Mass., Oct. 29, 1901.

To the City Council of the City of Lowell:

Gentlemen — A petition signed by Jerome F. Manning and others, asking that the city council "take such action in the premises that the Cook wells will be reopened," referred by your honorable body to the Lowell water board, October 22nd, 1901, has been received. A petition signed by Jerome F. Manning and others asking the water board to reopen the Cook wells has also been received.

It seems to us that the reasons which influenced the water board to order the discontinuance of pumping water at the Cook wells are sufficiently well known to the citizens of Lowell but as your honorable body has referred the matter to us, a review of the action of the Lowell water board in closing those wells and the reasons therefor will doubtless be of interest to you. The Cook wells, so called, were driven in the year 1893, and for several years were regarded by the water board as one of the best water supplies in the country so far as quality was concerned, though very limited in quantity. The tests which were made during the first few years were entirely satisfactory. It was not then the custom of the State board of health to analyze water to ascertain its action upon lead pipes.

Owing to the fact that a large number of cases of lead poisoning in several of the towns of the State were found to be caused by the water publicly supplied to those towns, which was of such a character as to attack lead, the State board of health in 1898 and 1899 caused investigations to be made in order to learn the nature and degree of the action of the various public water supplies of the State upon lead and to ascertain facts in regard to the occurrence of lead poisoning in these towns. As a result of those investigations the State board of health sent a communication dated June

29th, 1899, to the water board of the city of Lowell in which they say in part: "The State board of health has recently made investigations in the city of Lowell with reference to the action of the water of the public water supply of the city upon the service pipes through which the water is supplied to consumers, a large proportion of which, it appears, is of lead.

"In the course of the investigations many samples of water have been collected from lead service pipes in various parts of the city, and the result of the analyses have shown the presence of lead in all cases where the water has been drawn through pipes of that metal, and in many cases the quantity of lead present has been found to be dangerously large.

"In connection with this investigation information has been collected from about one-fifth of the physicians in the city, who report about forty cases of lead poisoning, some of which are of a very serious character, all of which have occurred within the last five years, or since the introduction of well water. Wherever practicable, samples of drinking water supplied from the house faucets in the houses of persons suffering from lead poisoning have been collected and analyzed, and the results in all cases have shown the presence of lead generally in large quantities.

"The ground waters in the State which take lead from pipes are found to contain an excess of carbonic acid and the waters from the Cook and Hydraulic wells are found to contain more carbonic acid than any other water supply in the State." (See communication from State board of health, June 29th, 1899.)

The above communication was read in the meeting of the water board July 3rd, 1899, and a committee of the board was appointed to confer with the local board of health.

At a meeting of the Water board held July 31st, 1899, the following communication from Middlesex North District Medical society was read and referred to the committee previously appointed to confer with the board of health.

REPORT OF THE WATER BOARD.

Lowell, July 29th, 1899.

Mr. Frank L. Weaver, President Lowell Water Board.

Dear Sir — At a Meeting of the Middlesex North District Medical Society it was voted that the accompanying resolution be sent to the water board of this city.

Resolved — That as a number of cases of lead poisoning have come to the notice of the physicians of the city the Middlesex North Medical Society think it would be advisable for the water board to make a thorough investigation of the water supply and its connection with reported cases.

Yours very truly,

Signed, W. G. EATON, Secretary.

August 4th 1899, the committee appointed to confer with the board of health reported that they had a conference with said board, and that the board of health granted a public hearing, at which representatives from the the State board of health were present and presented their evidence regarding the finding of lead poison in the water. Another communication dated September 25th, 1899, was received from the State board of health from which we quote :

"Since June, when the State board of health notified you of the danger to the citizens of Lowell from using the public water supply drawn through lead pipes, the board has been informed by physicians in Lowell of thirty-three new cases of lead poisoning, some of which are very serious.

"It now appears from the reports of these physicians, who comprise but one-fourth of the whole number of physicians practicing in Lowell, that in their practice they have occurred since the first of January, 1899, the following severe cases of lead poisoning, namely, nine cases of partial paralysis of the legs, ten cases of partial parrlysis of the hands and wrists, and twenty six cases of

lead colic, besides many cases of the milder effects of lead poisoning, which were arrested by treatment and discontinuing the use of city water.

Further examination for lead in the water upon the south side of the river shows very dangerous quantities existing in the water running through the pipes when in ordinary daily use. These quantities of lead average much higher than those found last year indicating an increased action of the water upon the pipes from year to year.

"To guard against lead poisoning to an appalling extent in the city of Lowell, two courses appear to be at hand; one is to remove all lead service pipes through which the water from the Cook and Hydraulic wells is drawn for drinking and cooking, and the other is to cease using the Cook and Hydraulic well water and extend the Boulevard well system to supply the whole city. The public health requires that one or the other remedy be applied as soon as possible." (See communication from State board of health, September 25, 1899).

Notwithstanding the severe condemnation of the Cook wells contained in the above letters from the State board of health, the water board determined to have an examination made under their own direction and for that purpose engaged Professor Charles Harrington of Harvard university to make a thorough examination and analysis of the water supplied from the different well systems. February 15, 1900, Prof. Harrington submitted his report. February 26, 1900, Prof. Harrington was present at the meeting of the water board and his report was discussed and it was voted to have further samples sent to him for a final report.

April 7th 1900, Professor Harrington presented his final report, in which he condemned the Cook well water even more severely than did the State board of health. He states on page 13 of his report that, "Inquiry shows that of the fairly numerous cases of lead poisoning which have occurred in Lowell, nearly all are to be attributed to the use of Cook water."

REPORT OF THE WATER BOARD

2.

In May 2, 1899. The Cook well system was abandoned. The amount of water for these purposes is estimated as follows: In the last year of the system water was very abundant and the cost of purification was the same as for the other systems. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration.

The water board has been very careful to maintain the water supply in abundance. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration. The fact that the water was abundant and the cost of purification was the same as for the other systems is a very important consideration.

The above extracts from the report of the State board of health, the report of Prof. Harrington and the statement of the Middlesex North District National society ought to convince any reasonable man that the continued use of Cook and Hyde Park well water would be extremely dangerous to the public health. The water board was extremely reluctant to close the Cook wells and it was only after the most thorough investigation covering a period from the receipt of the first communication from the State board of health on June 29th, 1899, to the final report of Prof. Harrington on April 7, 1900, that the board finally determined to abandon the wells. And we desire to call your attention particularly to the fact that although it was well known to every citizen that the Cook wells were practically condemned by the State board of health and that the abandonment of those wells was the most likely outcome, not one citizen ever appeared before the water board to protest against such abandonment. The wells were closed because in the judgement of everybody whose duty it was to consider the matter it was absolutely necessary so to do.

The citizens of Lowell have great reason to congratulate themselves that they have been fortunate enough to secure an additional well supply which answers every requirement for drinking and domestic purposes and which in no way attacks the public health.

The Cook wells are now maintained as a reserve supply. If exigency demands, we shall re-open them, but so long as we are able to secure a sufficient supply of our present pure water we should deem such re-opening extremely unwise, and if such re-opening were to be permanent we believe in the face of all the evidence such a proceeding would be a criminal disregard of the public health.

To re-open those wells as requested by the petitioners, "so that people using the water therefrom may have opportunity to test the quality of the same," would be an utterly senseless proceeding, as the temporary use would prove nothing, and a permanent re-opening, which would imperil the health of the inhabitants of the city, could not be permitted, simply to allow a few individuals an opportunity to test the quality of the water.

We transmit herewith the correspondence between the State board of health and the Lowell water board, and the report of Professor Harrington, and respectfully refer you to the reports of the State board of health for the year 1899 and the report of the Lowell board of health for the same year. If any further information is desired, we will be pleased to meet your honorable body or any committee thereof.

Respectfully submitted,

FRANK L. WEAVER,
AUGUST FELS,
MICHAEL J. DOWD,
HERBERT C. TAFT,

Lowell Water Board.

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decreased from \$210,149.93 to \$201,122.22 and the balance fell from \$38,132.05 to \$18,309.60 and uncollected carried over to 1902 increased from \$34,639.92 to \$44,056.64, which is mostly in the December meter account. A study of the reports of the Superintendent and Secretary will show the details of the department work.

FRANK L. WEAVER, President.

AUGUST FELS,

MICHAEL J. DOWD,

H. C. TAFT,

Lowell Water Board.

LOWELL WATER WORKS OFFICE,

January 1, 1902.

TO THE LOWELL WATER BOARD:

Gentlemen :— Herewith I submit figures detailing the finances of the Lowell Water Works for the year ending December 31st, 1901.

J. W. CRAWFORD, *Clerk.*

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1901.

TABLE I.	CHARGES.					RECEIPTS					
	WATER			Other than Water	Total Charges 1901	Total Charges 1900	BY ACCOUNTS			Due	
	Rate	Metered	Total				Receipts	Discounts	Abatements		
Transfer,											
Feb.	27 37		27 37	1,739 91	34,639 92	36,767 42	29,563 30	3,020 37	753 42	1,302 83	
Mar.	50,019 14	33,884 19	83,903 33		1,767 28	526 58	1,648 25	6 30	21 60	91 13	
Apr.	433 42		433 42	1,139 81	83,903 33	99,246 31	73,979 50	8,369 34	1,402 43	152 06	
May	906 02		906 02	1,614 06	1,573 23	3,424 17	1,441 55	45 38	32 49	53 81	
June	1,215 55	53,764 01	54,979 56	1,092 85	2,520 08	2,997 66	2,152 63	88 31	31 44	247 70	
July	422 17		422 17	1,117 40	1,539 57	1,708 15	1,205 45	38 28	49 50	246 34	
Aug.	182 08		182 08	1,090 61	1,272 69	2,018 41	967 59	17 89	50 43	236 78	
Sept.	164 56	42,295 77	42,460 33	1,536 46	43,996 79	38,034 72	38,357 00	4,104 39	19 23	1,516 17	
Oct.	1,056 18		1,056 18	2,624 76	3,680 94	1,692 56	2,124 14	12 76	145 01	1,399 03	
Nov.	46 12		46 12	1,333 85	1,379 97	1,188 86	150 11	15		1,229 71	
Dec.	195 30	35,153 42	35,348 72	1,243 09	36,591 81	37,150 07	534 08	33 67	4 73	36,019 33	
TOTALS,	54,667 91	165,097 39	219,765 30	14,532 80	268,938 02	269,132 99	201,122 62	21,092 32	2,656 44	44,066 64	

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1901.
OUTGO.

TABLE II.	Pay Roll and Salaries	Water Works Supplies	Interest and Principle	Refund and Vacancies	General Expense Account	Stable Department	Fuel	New Wells	Total	
									1901	1900
Jan.	3,534 59	657 05	200 00	76 10	125 44	41 51			4,634 69	10,380 24
Feb.	3,769 10	602 97	9,210 00	30 22	218 74	165 83			13,996 86	14,914 55
Mar.	5,485 96	10,299 42	220 00		100 45	376 70	166 14		16,648 67	6,550 43
Apr.	5,250 25	2,499 94		40 80	121 72	72 46	215 82		8,200 99	14,082 61
May	5,507 76	3,185 21	19,014 00	683 94	273 96	24 74	421 09		29,110 70	33,706 86
June	7,327 93	2,242 96	440 00	83 07	541 93	278 59	129 91		11,044 39	12,092 10
July	5,807 41	2,729 03	19,900 00	192 48	79 68	53 02			28,761 62	16,418 84
Aug.	6,687 86	3,385 87	3,110 00	47 36	303 52	35 62	4,275 45	800 00	18,645 68	15,603 43
Sept.	4,854 68	3,539 06		88 22	240 62	76 35	1,215 85	1,852 71	11,967 49	8,845 71
Oct.	5,810 60	1,607 84	4,500 00	47 77	190 58	179 10	4,092 37	1,705 90	18,134 16	17,425 53
Nov.	7,167 80	1,815 14	30,814 00	14 59	496 40	61 88	538 47	712 79	41,621 07	41,273 41
Dec.	5,658 10	5,994 77	500 00	91 08	187 99	144 04	3,546 23	2,158 14	18,278 35	11,341 59
Totals,	66,860 04	38,559 26	87,908 00	1,395 63	2,881 03	1,509 84	14,601 33	7,229 54	220,944 67	202,634 80

FINANCIAL STATEMENT, LOWELL WATER WORKS, 1901.

SUBDIVISION OF "OTHER THAN WATER CHARGES" FROM TABLE I.

TABLE III	Money Paid	Expense Sinking Mortg.	Repairs of Mortg.	New Services	Changed Service	Labor and Material	Building Charges	Shut off Fines	Interest	Total	
										1901	1900
Feb.	449 24	45 11	205 78	33 20		946 13	58 45	2 00		1,739 91	526 58
Mar.											
Apr.	610 00	82 39	65 31	214 25	25 79	113 73	20 34	8 00		1,139 81	2,289 02
May	977 00	118 71	57 16	251 01	6 95	198 90	6 24			1,614 06	1,728 94
June	645 00	74 01	70 74	247 68	13 30	30 18	11 94			1,062 85	1,169 97
July	466 00	57 20	82 27	250 65	22 43	216 15	2 70	20 00		1,117 40	1,459 67
Aug.	461 00	56 40	42 19	330 50	7 45	157 73	21 54	14 00		1,090 61	1,505 73
Sept.	184 00	19 68	42 41	128 33	21 82	1,116 38	21 84	2 00		1,536 46	922 83
Oct.	467 00	58 95	40 18	209 52	38 55	1,573 88	15 18		221 50	2,624 76	1,521 20
Nov.	122 00	13 50	26 97	252 30	31 95	867 85	17 28	2 00		1,333 85	966 84
Dec.	387 46	44 80	48 61	45 50	7 05	701 33	8 34			1,243 09	6,845 53
Totals,	4,768 70	570 75	681 62	1962 74	175 29	5,920 35	183 85	48 00	221 50	14,532 80	18, 966 31

FINANCIAL STATEMENT—LOWELL WATER WORKS.

SUBDIVISION OF "PAY ROLL AND SALARIES" FROM TABLE 2.

TABLE IV	Salaries	Office and Inspectors	Meter and Work	Extension and Con- struction	Engineer- ing	PUMPING STATIONS				Mainuten- ance.	Services	Recharged Sundry Persons	TOTAL	
						No. 1	No. 2	No. 3	No. 4				1901	1900
JAN.	183 33	622 46	156 62	137 28		508 86	331 55	43 90	342 32	1,092 40	55 84		3,534 59	4,306 50
FEB.	183 34	667 40	201 75	76 70		608 85	434 41	209 26	364 24	1,009 15		14 00	3,709 10	4,070 91
MAR.	183 33	836 25	431 25	95 88	405 25	743 15	526 92	210 11	674 45	1,321 99	17 75	39 63	5,485 96	4,794 51
APR.	183 33	671 40	328 88	652 47	84 00	632 81	369 81	49 75	532 30	1,509 78	235 72		5,250 25	5,205 96
MAY	183 34	671 40	307 39	613 87	116 00	629 97	91 42	154 33	593 72	1,922 24	209 08	15 00	5,507 76	5,373 22
JUNE	183 33	839 25	349 00	582 50	116 75	810 81			677 91	3,432 73	335 65		7,327 93	6,543 40
JULY	183 33	671 40	222 75	113 70	94 00	755 05	180 12		423 79	2,908 02	241 25	14 00	5,807 41	4,764 31
AUG.	183 33	839 25	269 11	545 84	108 88	866 29	43 56	17 34	712 14	2,759 46	332 65	10 00	6,087 85	4,585 36
SEPT.	183 33	671 40	203 50	270 43	91 50	676 47		144 00	489 29	1,631 91	227 25	265 60	4,854 68	5,470 37
OCT.	183 33	671 40	217 75	1,001 24	108 75	677 35		31 28	508 57	1,680 06	294 66	436 21	5,810 60	4,069 89
NOV.	183 34	839 25	291 75	626 20	92 00	926 40	6 38		629 06	3,104 19	213 05	256 18	7,167 80	4,730 22
DEC.	183 33	740 30	323 06	85 08	108 33	811 73	240 88	481 34		2,610 12	39 68	32 25	5,656 10	4,099 77
TOTALS	2,200 00	8,741 16	3,302 81	4,801 19	1,325 46	8,647 74	2,285 05	860 05	6,429 13	24,982 05	2,202 58	1,082 87	66 860 04	59,514 42

FINANCIAL STATEMENT, LOWELL WATER WORKS, 1901.

RECAPITULATION OF "OTHER THAN WATER CHARGES" FROM TABLE I.

TABLE III	Meters Sold	Expenses on Selling Meters	Repairs on Meters	Rep Services	Change of Service	Labor and Material	Liquidating Charges	Went off Files	Interest	Totals	
										1901	1900
Feb.	449 24	45 11	205 78	33 20		940 18	56 45	2 00		1,990 01	690 68
Mar.											
Apr.	610 00	82 20	65 31	214 25	25 79	118 73	20 34	8 00		1,180 81	9,980 09
May	977 00	118 71	57 16	251 01	6 06	190 09	6 24			1,614 00	1,799 94
June	645 00	74 01	70 74	247 68	13 30	30 18	11 94			1,092 86	1,169 97
July	466 00	57 20	82 27	250 65	22 43	216 15	2 70	20 00		1,117 40	1,459 67
Aug.	461 00	56 40	42 19	330 50	7 45	157 73	21 54	14 00		1,090 61	1,505 73
Sept.	184 00	19 68	42 41	128 33	21 82	1,116 38	21 84	2 00		1,530 46	922 83
Oct.	467 00	58 95	40 18	209 52	38 55	1,573 88	15 18		221 50	2,624 76	1,521 20
Nov.	122 00	13 50	26 97	252 30	31 95	867 85	17 28	2 00		1,333 85	966 84
Dec.	387 46	44 80	48 61	45 50	7 05	701 33	8 34			1,243 09	6,845 53
TOTALS,	4,768 70	570 75	681 62	1962 74	175 29	5,920 35	183 85	48 00	221 50	14,532 80	18, 966 31

FINANCIAL STATEMENT—LOWELL WATER WORKS.
SUBDIVISION OF "PAY ROLL AND SALARIES" FROM TABLE 2.

TABLE IV	Salaries	Office and Inspectors	Meier Work	Extension and Con- struction	Engineer- ing	PUMPING STATIONS				Malinten- ance.	Services	Recharged Sundry Persons	TOTAL	
						No. 1	No. 2	No. 3	No. 4				1901	1900
JAN.	183 33	622 46	156 62	137 28		508 86	391 55	43 90	342 32	1,092 40	55 84		3,534 59	4,306 50
FEB.	183 34	667 40	201 75	76 70		608 85	434 41	209 26	364 24	1,000 15		14 00	3,769 10	4,070 91
MAR.	183 33	836 25	431 25	95 88	405 25	743 15	526 92	210 11	674 45	1,321 99	17 75	39 63	5,485 96	4,794 51
APR.	183 33	671 40	328 88	652 47	84 00	632 81	369 81	49 75	532 30	1,509 78	235 72		5,250 25	5,205 96
MAY	183 34	671 40	307 39	613 87	116 00	629 97	91 42	154 33	593 72	1,922 24	209 08	15 00	5,507 76	5,373 22
JUNE	183 33	839 25	349 00	582 50	116 75	810 81			677 91	3,432 73	335 65		7,327 93	6,543 40
JULY	183 33	671 40	222 75	113 70	94 00	755 05	180 12		423 79	2,908 02	241 25	14 00	5,807 41	4,764 31
AUG.	183 33	839 25	269 11	545 84	108 88	866 29	43 56	17 34	712 14	2,759 46	332 65	10 00	6,687 85	4,585 36
SEPT.	183 33	671 40	203 50	270 43	91 50	676 47		144 00	489 29	1,631 91	227 25	265 60	4,854 68	5,470 37
OCT.	183 33	671 40	217 75	1,001 24	108 75	677 35		31 28	508 57	1,680 06	294 66	436 21	5,810 60	4,669 89
NOV.	183 34	839 25	291 75	626 20	92 00	926 40	6 38		629 06	3,104 19	213 05	256 18	7,167 80	4,730 22
DEC.	183 33	740 30	323 06	85 08	108 33	811 73	240 88	481 34		2,610 12	39 68	32 25	5,656 10	4,999 77
TOTALS	2,200 00	8,741 16	3,302 81	4,801 19	1,325 46	8,647 74	2,285 05	860 05	6,429 13	24,982 05	2,202 58	1,082 87	66,860 04	59,514 42

TABLE V.
FINANCIAL STATEMENT—LOWELL WATER WORKS
1901.

SUBDIVISION "WATER WORKS SUPPLIES" FROM TABLE 2.

Pumping Station No. 1 supplies, (Centralville)	\$ 945 15
" " " 2 " (Cook)	218 68
" " " 3 " (Hydraulic)	4 63
" " " 4 " (Boulevard)	3,789 23
Cast Iron Pipe and Specials,	4,916 23
Hydrants and gates and gate boxes,	3,668 42
Service pipe,	3,755 94
Meters,	11,135 58
Machinery and tools,	561 40
Brass work,	427 98
Electric plant, Station No. 1, (Centralville)	3,235 89
" " " " 4, (Boulevard)	765 00
Miscellaneous,	5,135 13
	\$38,559 26

TABLE VI.
FINANCIAL STATEMENT—LOWELL WATER WORKS.

DETAIL OF "PRINCIPLE AND INTEREST" FROM TABLE NO. 2.

	Amount of debt Jan. 1, 1902.	Rate	Interest Paid 1901	Principal Paid 1901	Amount of debt Jan. 1, 1902
Water loan bonds	1,000,000 00	4 %			1,000,000 00
26 coupons No. 20, Nov. 1, 1900,			720 00		
1002 coupons No. 21, May 1, 1901,			20,040 00		
939 coupons No. 22, Nov. 1, 1901,			18,780 00		
High service bonds,	75,000 00	4			75,000 00
15 coupons No. 39, May 1, 1901,			1,500 00		
15 coupons No. 40, Nov. 1, 1901,			1,500 00		
NOTES					
Lowell Inst. Savings,	6,000 00	4	120 00	6,000 00	
" " "	20,000 00	3½	700 00	5,000 00	15,000 00
" " "	28,700 00	4	1,148 00	4,100 00	24,600 00
" " "	20,000 00	4	800 00	10,000 00	10,000 00
Commonwealth of Mass.	50,000 00	4	2,000 00	5,000 00	45,000 00
Esterbrook & Co.,	75,000 00	4	3,000 00	7,500 00	67,500 00
	1,274,700 00		50,308 00	37,600 00	1,237,100 00

TABLE VII.

FINANCIAL STATEMENT—LOWELL WATER WORKS.
1901.

MAINTENANCE AND CONSTRUCTION STATEMENT.

MAINTENANCE.

Paid for labor :	
Salary of President and Superintendent,	\$2,200 00
Office and Inspectors,	8,741 16
Pumping stations,	18,221 92
Meter work,	3,302 81
Engineering,	1,325 46
General Maintenance,	24,982 05
Cost of Material :	
Out-put as per stock book,	1,896 37
Interest,	50,308 00
General Expense,	2,881 03
Stable,	1,509 84
Machinery and tools	561 40
Pumping Station supplies,	4,957 69
Coal,	23,752 11
	<hr/>
	\$144,639 84

CONSTRUCTION.

Paid for labor,	\$7,003 77
Paid for material	
Out-put as per stock book,	9,835 50
Electric light plants,	4,000 89
New well plant,	7,229 54
City meters,	8,484 00
Payment on loans,	37,600 00
	<hr/>
	\$74,153 70

TABLE VIII.

FINANCIAL STATEMENT—LOWELL WATER WORKS,
1901.

DRIVEN WELLS LOANS.

Balance January 1, 1901,		\$12,596 76
Alterations at Pump Station, No. 1,	\$3,020 01	
Iron pipe,	• 188 17	
Land,	990 16	
Material,	115 61	
Pay-roll,	8,282 81	
	<hr/>	\$12,596 76

Superintendent's Report.

Lowell, Mass. January 1, 1902.

To the Lowell Water Board —

GENTLEMEN:—I herewith present the Annual Report of the Superintendent of Water Works for the year 1901.

The construction work or addition to the system during the year has been comparatively extensive and varied, viz: The completion of the extension of the Boulevard Well plant and the erection of a new Pumping Station in connection therewith, installation of an Electric Plant at the Centralville Pumping Station for power and lighting and the placing of a lighting set at the lower Boulevard Pumping Station for lighting that Station and also the upper one; setting 1025 meters, 757 being city meters; laying 8392 feet of street main and the addition of 186 services, also eight new fire hydrants and 43 additional valves were set on street mains. Many of these improvements were of an extraordinary nature, yet the cost of them was borne to a great extent from the revenues of the department, which accounts for the increased annual expenditure over previous years.

Undoubtedly the most important work of the year, both from the standpoint of expense and the results obtained, was the extension of the Boulevard system of wells. The successful accomplishment of this work makes the source of our supply more compact and available in connection with the original construction of the Works than formerly and means a reduction in the cost of labor for pumping. It also enables the department to dispense with the use of the water from the Cook and Hydraulic Wells, which the investigation authorized by your Honorable Board as well as that of the State Board of Health showed to be dangerous for continuous use when drawn through lead pipes.

BOULEVARD WELLS EXTENSION.

After a thorough testing for the most available territory to establish this new or Upper Boulevard Well Plant, a location was selected northerly of Pawtucket Boulevard about 300 feet from the Merrimack River on land formerly owned by Cushing, Gaudette, Stiles and others, and centering on the easterly line of what was known on the plan as "Wellington Street," about 130 feet northeasterly of north line of Pawtucket Boulevard. The plan proposed and followed was to run two lines or legs east and west parallel with the Boulevard from a central collector or cross 24" x 24" x 16" x 16" each outlet controlled by gate valves; one 24" outlet running to new or Upper Boulevard Station and the other to old or Lower Boulevard Station and the well or suction lines leading from the 16" openings. These suction lines consist of 786 feet of 16" flanged and 783 feet of 14" flanged pipe,

laid to grade and line on piles driven in bottom of trench. The depth at which the pipe was laid varied from six to 14 feet according to the surface of the ground. Each length of suction pipe was cast 12 feet long with a 2½" boss on side, tapped to receive a 2½" pipe for connecting wells. The number of wells driven and connected in this plant was 125, all of which consist of 2½" strainers 36" long, 2½" x strong W. I. pipe, malleable tees or heads, fitted with air chambers and caps and each well controlled separately by a 2½" valve. Every valve fitting and pipe used on wells or suction was submerged in water and subjected to a test of 25 lbs. air pressure before using. When the wells were driven and connected they were made available for use by means of the 24" delivery and 20" suction mains connecting the Lower Boulevard Pumping Station. This delivery main is 1892 feet long running from center of suction main or collector at the Upper Wells to a 24" Y on southerly side of Boulevard opposite Lower Station. 1038 feet of this pipe is convertible into a suction so that the Lower Station can, by the operation of a series of valves, pump from all the 345 wells included in both the Upper and Lower Plants. To do this, however, use must be made of the 811 feet of 20" and 147 feet of 16" pipe which was laid as a suction for the additional 52 wells driven in the spring of 1900 for the purpose of relieving to 14" suction pipe that was already loaded to its full capacity with the water from 76-2½" wells. This pipe connects with the 24" delivery main about half way between the new and old Pumping Stations and by closing a valve at that point both stations can pump independently of each other, either singly or together. The following valves were set on suction and delivery mains: 2-12", 1-14", 2-15", 1-20" and 4-24". Suction mains were laid to a grade of .08 per 100 feet and grade of the delivery mains was such as to allow draining of all pipes when necessary.

UPPER BOULEVARD PUMPING STATION.

The new pumping station was built on land near the site of the Gaudette residence. The building, which is of wood, is 59 feet long by 33 feet wide, the engine room being 29 x 33 feet, and the boiler room 30 x 33 feet in addition, there is an office 13 x 13 feet, coat room 10 x 12 feet, and the coal shed, which is 59 x 58 feet. In order to place the pump at a proper depth the engine room or pump pit was excavated $13\frac{1}{2}$ feet below the underpinning of the building. The walls of the pump pit are of brick 18" thick with a concrete core and extend to elevation 48.85, which is three feet higher than the brick work at the Lower Station and the same above high water mark. The floor of the pump pit is made of Portland cement concrete one foot thick.

Just outside of the Station in front of the office where the valves were set on 20" x 20" x 16" x 16" cross or collector, a gate chamber was built with a man-hole extending above ground. This gate chamber is connected by tunnel with engine room. Tunnel, gate chamber and man-hole were made of Portland cement concrete. At the approach to the tunnel directly under the office is set a Receiver 6 feet in diameter by 12 feet long made of best steel and furnished by B. F. Smith and Bro. of Boston. One end of the Receiver is connected by 24" flange pipe to well line and the other by a 24" to 20" reducer to the two Worthington Duplex Compound Pumps 14-20-15-15 which were moved from the Hydraulic Pumping Station. Besides these two pumps, which have each a capacity of three million gallons daily, there is a Worthington Air pump 6-8 $\frac{1}{2}$ -6, a Worthington boiler feed pump and a Deane boiler feed pump 6-4-6; these also came from the Hydraulic Station, as did the boilers. The boilers are what is known as the horizontal tubular type and are $16\frac{1}{2}$ feet long by 66 inches in diameter, they are connected with a smoke stack 36" in diameter, 72 feet high, made of steel in sections $\frac{5}{16}$, $\frac{1}{4}$ and $\frac{3}{16}$ of an inch thick.

This work including piping boilers and pumps is nearly finished. What now remains to be done is the flooring of the boiler room and top dressing the engine room floor. Outside the Station a great deal of grading was found necessary and some more will have to be done next year. In connection with the extension of the Boulevard Wells also comes the expense of moving the Gaudette house and barn. The latter was moved to the rear of the old Station, set on stone foundation and is now used for a horse shed and storage purposes. The house was moved to point about 100 feet west of the Collins house between the river and the Boulevard. The interior of the house had to be remodeled and considerable grading was done around both houses. A wind mill was also erected to supply them with water.

ELECTRIC ENGINE AT CENTRALVILLE STATION.

The electric set at the Centralville Pumping Station is comprised of a 9" x 10" Ames Automatic Cut-off Engine which runs at 315 R. P. M. and is directly connected to a 25 K. W. General Electric Generator. From the generator is supplied a 110 volt direct current which operates a 15 H. P. General Electric Motor, which in turn drives the Shop. The Generator also furnishes the current for 106 incandescent and 5 arc lights. The cost of lighting and power, based on extra fuel used, oil, waste, new globes, lamps, carbons, interest, etc., is \$2.10 per day, of which .60 per day is chargeable to lighting Pumping Station, or \$219 per annum against \$428.10 the former cost of lighting per year. Since this plant was started last July it has worked every day without the least trouble. To operate the old steam engine which furnished power for the shop, 800 lbs. of coal was required while 700 lbs. is consumed by the new Ames Engine for power and lighting. Steam for this engine is taken from the main steam line of the High Duty

1

Worthington at 90 lbs. and the exhaust is connected with the condenser of the three large pumps and is also piped to the atmosphere.

NEW METERS.

By far more meters were set during the past year than in any one year in the history of the Department. The work of setting which was done as rapidly as possible, required the services of two extra men and part of the time four extra men were employed. Some of the pipes where the meters were set proved to be old and badly rusted, making it difficult and more expensive to set the meters than ordinarily. The men engaged in the work reported leaky fixtures in most of the houses metered by the City.

Leaky fixtures in general and wanton waste of water are the most serious drawbacks to the success and efficiency of Water Works systems and the action of your Honorable Board in increasing the number of meters is a move in the right direction.

METERS RUNNING January 1st, 1902.

SIZES.	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	1 $\frac{1}{2}$ "	2"	3"	4"	6"	Total.
Columbia.....	111	5							116
Crown.....	2476	1560	295	16	17	2	5	2	4373
Desper.....	32	18	6						56
Duplex.....	4	6	5						15
Empire.....	181	39	2						222
Frost.....		3	1						4
Gem.....					6		2	2	10
Hersey.....	312	84	7	1					404
Lambert.....	460	63	7						530
Metropolitan.....		1							1
Nash.....	87	67	42						196
Niagara.....	1	1							2
Thomson.....	5	20	3						28
Trident.....	252	29	1						282
Union.....	18	10		1					29
Worthington.....	144	27	53	70	36	7	3		340
Westinghouse.....		1							1
TOTAL.	4083	1934	422	88	59	9	10	4	6609

PRIVATE METERS RUNNING January 1st, 1902.

SIZES.	$\frac{1}{4}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	2"	Total.
Columbia.....		9				9
Crown.....	1	25	22	2		50
Desper.....		1	3	1		5
Duplex.....		1				1
Empire.....		2				2
Frost.....		2	1			3
Hersey.....		6	1			7
Lambert.....		6				6
Nash.....		11	2		1	14
Thomson.....			1			1
Trident.....		5				5
Worthington.....				1	3	4
TOTAL.....	1	68	30	4	4	107

NEW STREET MAINS, HYDRANTS, ETC.

About the average yearly amount of street work was done during the year, none of which needs particular mention and all of which will be found set forth in detail in the schedules accompanying this report :—

HYDRANTS, JANUARY 1st, 1902.

KIND.		2 Nor's.	3 Nor's.	4 Nor's.	Total.
Boston Machine.....			172		172
Chapman.....		3	105	49	157
Coffin.....			1		1
Corey.....			1		1
Eddy.....			32	1	32
Flush.....	443				443
Holyoke.....				1	1
Ludlow.....		3	222	1	226
Michigan.....			60		60
Perkins.....				1	1
Lowrey.....	11				11
TOTAL.....	454	6	593	53	1106

PRIVATE HYDRANTS JANUARY 1, 1902.

KIND.		1 Noz.	2 Noz's.	3 Noz's.	4 Noz's.	Total.
Boston Machine.....			1	8		9
Chapman.....		1	4	1	5	11
Coffin.....				1		1
Flush.....	3					3
Kenney.....			1			1
Ludlow.....			18	13	10	41
Michigan.....				3		3
Perkins.....			3	1		4
TOTAL.....	3	1	27	27	15	73

NEW SERVICE—1901.

172	$\frac{1}{2}$ -inch Iron Tin Lined Pipe	6.94	feet
7	1-inch " " " "	250	"
2	1-inch Iron Pipe	62	"
1	1-inch " " " "	115	"
1	$\frac{3}{4}$ -inch Iron Pipe	37	"
1	$\frac{1}{4}$ -inch Iron Lead Lined Pipe	18	"
1	2-inch Iron Lead Lined Pipe	10	"
1	$\frac{1}{2}$ -inch Lead Pipe	9	"
<hr/>		<hr/>	
186		7,424	feet

Amount previously laid	418,075	feet
Total now laid	425,499	"
Total services laid	11,529	
Total cut off at main	788	
Total re-connected	58	
Total now in use	10,799	

SERVICES CHANGED — 1901.

No.	KIND.	Changed to				Total feet.
		Tin lined $\frac{3}{8}$ "	Tin lined 1"	Lead $\frac{5}{8}$ "	Lead $\frac{3}{4}$ "	
26	$\frac{3}{4}$ -inch iron	553	.....	.....	.....	533
1	$\frac{3}{4}$ -inch iron .....	.....	.....	.....	30	30
1	$\frac{3}{4}$ -inch iron .....	.....	33	.....	.....	33
5	1-inch iron	144	.....	.....	.....	144
5	1-inch iron .....	.....	112	.....	.....	112
1	1-inch iron .....	.....	.....	9	.....	9
39	TOTAL	697	145	9	30	881

MAINTENANCE.

Much of the expense of maintenance is occasioned by the alterations, change of grade, renewal and repairs necessary on street mains, hydrants, hydrant boxes, gates, gate boxes, service and service boxes. Some is due to repairs of meters but the greatest outlay charged to maintenance, next to the item of interest, is on account of pumping. For besides the regular supplies, such as coal, oil, etc., the boilers, piping and pumps are continually demanding care and repairs, scarcely a day passing when there is not a pump repair job in the Shop. At the Centralville Pumping Station the three large pumps and the High Service Pump came in for more or less repairing. New composition sleeves, glands and pistons and steel rods were made at the Shop and furnished for the High Service Engine, making it good for several years to come. Advantage was taken of connecting the exhaust from the electric engine with the High Duty Worthington condenser to also provide for the exhaust from the High Service engine, which was never done before.

The Morris Engine, which has been a constant source of expense to keep in condition for some years past, was started several times during the year, but after running a few days or a week, some part would give out, usually the steam valves on the high pressure side; four of these valves were broken during the year. At present the engine is in order, ready to start, but it cannot be relied upon.

The Low Duty Worthington Pump which was run considerably during the year, required very little repairing and is still in good condition. A reducing valve was set on the main steam line of the pump so that in case of stopping the High Duty Worthington, the pump could be started immediately without waiting for the steam pressure to drop from 90 to 50 lbs. or vice versa. Considerable repair work was done on the High Duty Worthington

Pump since the last Report ; all of the composition boxes on the valve motion were worn so badly that it became necessary to replace them. This was done and the new boxes were cast of bronze. A new cross head for the air pump also had to be purchased.

Very little repair work was done at the Cook Wells Pumping Station, which was due in a measure to the fact that the Station was shut down May 1st and that previous to that for about a year only a little pumping was done there. The taking out of one of the air pumps for use at the Boulevard necessitated some new piping. Since the freezing weather began it has been necessary to keep the water in the suction mains moving, otherwise some of the lines which are laid practically on the surface, would freeze and burst. This was done by pumping through the 12" blow-off into the brook. This trouble will be obviated before another winter, as your vote to have these suctions liable to freeze lowered to proper depth, will be carried into effect.

The Hydraulic Pumping Station ran 49 days during the year, shutting down finally May 11th. Since that time all the machinery, boilers, piping, etc., forming the outfit at the Station were removed to the Upper Boulevard Pumping Station, excepting the condenser and vacuum pump, which is being used at the Lower Boulevard Station. Nothing of value remains there now but the building and the old brick used in the boiler setting. As soon as the building is disposed of, the engine pit, which is now almost full of water, should be pumped dry and then filled with clean material from the sand bank near by and the rest of the lot cleaned and graded.

The discontinuance of the Cook and Hydraulic Wells left the entire supply of the City dependent on the Boulevard Wells and Pumping Station, which Station was enlarged in 1900 and two new boilers and a new pump added to its equipment to meet these

conditions. The new pump, like the other two, is a 12-18-18 simple duplex Knowles pump of 3,000,000 gals. daily capacity. The steam cylinder on the old pumps were reduced by B. F. Smith & Bro. in 1896 from 12" to 9½". They should now be restored to their original size as the new pump proves the larger steam cylinder the best in efficiency. A Worthington duplex air pump which was formerly at the Cook Pumping Station has been added to the Pumping equipment, making two air pumps, two boiler feed pumps and one vacuum pump, besides the large pumps at this Station. The two new boilers, like the old two, are horizontal tubular 54" in diameter, 17 ft. .3 in. long with overhanging fronts. In cleaning the old boilers, the tubes were found so badly scaled that it was thought wisest to have them replaced with new, which was done. Now only three of the boilers are run at a time, thereby giving a chance to clean them regularly, and as a consequence, they are in first rate condition.

COAL.

As about one half the expense of pumping is for coal, it follows that the better the coal, the less the cost per million gallons. During the past year, the coal was of a specially inferior quality. So much so, that while the quantity of water pumped was 303,206,957 gallons less than in 1900, yet the consumption of coal was 269 tons in excess of the previous year, and the cost of pumping thereby increased from \$13.90 to \$16.26 per million gallons. This, too, notwithstanding the labor saved since May 1st by concentrating the pumping to two Stations instead of three as before. Of course some of the increased cost of pumping is due to the unusual amount of repairs made on the pumps at the Centralville and Boulevard Stations. Nevertheless, if it were not for the increase in the price of coal and a decrease in quality, a reduction in the cost of pumping would have been the case.

MAINTENANCE OF STREET MAINS, HYDRANTS, SERVICES, METERS, ETC.

Next in importance to the maintenance of the Pumping Stations is the work of caring for and preserving in condition the street mains, services, hydrants, meters, etc., attached to the delivery and distributing branch of the work.

Following is some of the work done in that direction :—
336 ft. of 20" main running through land of Merrimack Manufacturing Co. was taken up and relaid in another location to make room for an extension to one of their mills. While the Street Department were engaged in rebuilding the bridge on Lawrence Street near the Lowell Cemetery, the 4" main which extended from the 8" main on Lawrence Street opposite Moore Street across the bridge was taken up and replaced by an 8" pipe. The pipe laid on the bridge was covered with 2" felting and boxed to prevent freezing. Owing to numerous complaints of roily water on Cottage Street, the 1½" pipe on that street was replaced by a 4" case iron main from Chapel to Central Street. While the men were employed in blowing off hydrants on Varnum Avenue, they noticed a decided lack of pressure at the hydrant nozzles ; this lead to an inspection, which resulted in the discovery of a large leak from an 8" main where it crossed a brook. The culvert over the brook was removed and the leak repaired in such a manner as to avoid its occurring again. Fifteen old, broken or condemned post hydrants and sixteen flush hydrants were replaced by new post hydrants. Nine hydrants were discontinued and removed. Three other hydrants were relocated and a 6" condemned street gate replaced. Thirty-seven street gates were repacked or otherwise repaired, and 323 hydrants reported out of order were fixed. The

drinking fountains were painted once and cleaned 17 times during the year. Thirty-nine old iron services which were beyond repair were changed for tin lined iron pipe and 23 services were cut off at main; 429 meters were taken to Shop for repairs, 220 were repaired in cellars, 59 were frozen and burst, 29 condemned and 2 discontinued; 280 new 1" sidewalk boxes, 22 new valve boxes and 6 new hydrant boxes were set in place of old decayed boxes; 39 leaks were also repaired.

MISCELLANEOUS.

In addition to the usual regular work already noted, several other pieces of work were done during the year as follows: A new drinking fountain was set on Riverside Street near the corner of Moody Street; new rail fence 888 ft. long was built along the northerly line of City land westerly from Boulevard extension, also filling cellar on site of proposed Cushing house; saving about twenty-five tons of hay from Reservoir and Boulevard land. Sheathing and clapboarding Lower Boulevard Pumping Station; laying pipe for fire services for Merrimack Manufacturing Co., Tremont & Suffolk Mills, Bay State Woolen Mills, Wamesit Power Co., Shaw Hosiery, Lowell Gas Light Co., and American Hide & Leather Co.; making beds, hauling loam, etc. for ivy plants, shrubbery and beds ordered by the Committee on flowers and set out on the Bodwell Lot, Riverside Street and the Inlet Lot on Varnum Avenue.

Total gross pumpage for the year	4,864,856,916	Gallons
Total pumped into High Service	59,087,392	"
Total net pumpage	2,576,064,071	"
Total number of tons of coal consumed		
in pumping—2000 lbs. per ton	5,611	

Total expense of pumping.....	\$42,542.68	
Average cost of pumping a million gal- lons based on expense of pumping Low Service.....	\$16.26	
Charges for water, metered rates.....	\$165,097.39	
Charges for water, schedule rates.....	\$54,667.91	
<hr/>		
Total charges.....	\$219,765.30	
Total receipts.....	\$201,122.22	
Total expenditures.....	\$220,944.67	
Expended for maintenance.....	\$94,331.84	
Expended for interest.....	\$50,308.00	
Average cost of a million gallons, based on maintenance and interest.....	\$56.13	
Total consumption of water.....	2,576,765,224	Gallons
Average daily consumption.....	7,059,631	"
Per capita consumption, based on 95,000 population.....	74.31	"
Price received per million gallons con- sumed	\$78.07	
Price charged per million gallons meter rates.....	\$167.96	
Number of services in use.....	10,799	
Number of meters in use.....	6,609	
Number of fire hydrants in use.....	1,106	
Total length of mains in miles.....	129.37	
Total number of wells, all told.....	555	
Total number of wells at Boulevard....	345	
Water Works debt reduced.....	\$37,600	

Respectfully submitted,

ROBERT J. THOMAS,
Superintendent.

LOW SERVICE—WATER PIPES LAID IN 1901.

STREETS.	BETWEEN WHAT STREETS.	LENGTH IN FEET.					Total
		4-in.	6-in.	8-in.	16-in.	20-in.	
Aiken ave.	Westerly from Hildreth.	417					417.0
Barker.	Between Hovey and Exeter.	311½					311.5
Barton ave.	Extended easterly.	10					10.0
Bassett.	Northerly to Hudson.	17					17.0
Bodwell ave.	Northerly to Third ave.	152					152.0
Boston road.	Between Fruit and Cunningham.		183				183.0
Boyntou.	Westerly to Hildreth.	349½					349.5
Broughton ave.	Between Lakeview ave. and Front.	231					231.0
Brunswick.	Northerly from Railroad.	279					279.0
Burlington ave.	Easterly to Wilder.	276					276.0
Canal.	On blow-off to canal.	33½					33.5
Chase ave.	Westerly from Mammoth road.	669					669.0
Chase.	Northerly from Swift.	305					305.0
Christian.	Southerly from Methuen.	621					621.0
Corson.	Easterly from Chelmsford.	178					178.0
Cottage.	Easterly to Central.	141½					141.5
Crawford.	Between 5th and 6th aves.	350					350.0
Cunningham.	Westerly from Boston road.	263					263.0
Endicott.	Northerly from 3rd ave.	53					53.0
Fort Hill ave.	Southerly to Rogers.	362½					362.5
Fruit.	Easterly to Boston road.	62					62.0
Highland ave.	Extended southerly.	96					96.0
Hildreth.	Northerly to Town line.	523½					523.5
Houghton.	Connected.	290					290.0
	Carried forward.	372½	601½	183			6174.0

LOW SERVICE—WATER PIPES LAID IN 1901 — *Continued.*

STREETS.	BETWEEN WHAT STREETS.	LENGTH IN FEET					Total
		4-in.	6-in.	8-in.	16-in.	20-in.	
	Brought forward	372½	5618½	183			6174 0
Ivy.....	Easterly from Brunswick.....		102				102.0
Lawrence.....	Between Moore and Lowell Cemetery			544½			544.5
**Payne.....	Easterly from School.....	210					210.0
Payne.....	Fire service to old box shop.....	13					13.0
Sarah ave.....	Northerly to Charles ave.....		257				257.0
School.....	Southerly to C.....		154				154.0
Shaw Stc'k' Co.	On fire service (private).....		133	134			267.0
Sixth ave.....	Westerly from Crawford		42				42.0
So. Whipple...	Extended southerly.....		36				36.0
Tanner	On fire service to Tremont & Suffolk Cotton storehouse.....		118				118.0
Third ave.....	Westerly from Mammoth road.....		381				381.0
Third ave.....	Between Bodwell and Endicott.....		223				223.0
Victoria	Extended westerly.....		150				150.0
Winter.....	Between Davis and South.....		250				250.0
Worthen.....	Extended.....					148	148.0
Worthen.....	Change of location on Merrimack Co.'s land.....					188	188.0
	Hydrants		48				48.0
	Street Car Sprinklers.....	56	27				83.0
	Laid in 1901.....	651½	7539½	861½		336	9388.5
	Less taken out Lawrence st.....						
	Worthern st. and Merrimack Mfg. Co	544½			116	336	996.5
	Total						8392.0

**Laid previously to 1901 and not listed.

Brought forward.....	8,392 feet
Low Service laid previous to 1901.....	637,284 "
Total Low Service to January 1, 1902.....	645,676.0 "
Total High Service to January 1, 1902.....	87,425.5 "
Total High and Low Service to January 1, 1902.....	683,101.5 "
Total in miles, 129.37.	

LOW SERVICE—LIST OF STOP GATES SET DURING 1901.

STREETS.	LOCATION.				
		4-in.	6-in.	8-in.	20-in.
Alken ave.....	12 feet north of south line Alken avenue, on west line Hildreth street.....	1			
Amory.....	On hydrant connection 6 feet from hydrant.....	1			
Amory.....	On hydrant connection 4.8 feet from hydrant.....	1			
Barker.....	12 feet west of east line Barker street, 1 foot south of north line Exeter street.....	1			
Barker.....	12 feet west of east line Barker street, on south line Hovey street.....	1			
Boynton.....	10 feet south of north line Boynton street, 13 feet west of east line Hildreth street.....	1			
Branch.....	On street car sprinkler stand pipe, 18 feet north of south line Branch, 49 feet west of junction Middlesex and Branch streets.....	1			
Broadway.....	On street car sprinkler stand pipe, 23.7 feet south of north line Broadway, 183 feet east of east line Fletcher street.....	1			
Broughton ave.....	6 feet east of west line Broughton avenue, on south line Lakeview avenue.....	1			
Brunswick.....	12 feet west of east line Brunswick street, 8 feet south of north line Railroad street.....	1			
Burlington ave.....	10 feet south of north line Burlington avenue, on west line Wilder street.....	1			
Canal.....	On blow-off 21.8 feet east of west line of Canal street, 43½ feet north of north line of street.....	1			
Central.....	On street car sprinkler stand pipe, 30½ feet east of west line Central street, 36 feet north of north line Middlesex street.....	1			
Chase ave.....	13½ feet south of north line Chase avenue, on west line Mammoth road.....	1			
Chase.....	11 feet east of west line Chase street, 4 feet north of north line Swift street.....	1			
Christian.....	12 feet east of west line Christian street, 81 feet north of south line Methuen street.....	1			
Cottage.....	15½ feet east of west line Central street, 4 feet south of north line Cottage street.....	1			
Corson.....	10 feet south of north line Corson street, on east line Chelmsford street.....	1			
Crawford.....	12 feet east of west line Crawford street, on south line Sixth avenue.....	1			
Cunningham.....	10 feet south of north line Cunningham street, on west line Boston road.....	1			

LOW SERVICE—LIST OF STOP GATES SET DURING 1901.

—Continued.

STREET	LOCATION.	4 in.			
		4 in.	6 in.	8 in.	10 in.
Fort Hill avenue.....	15 feet west of east line Fort Hill avenue on north line Rogers street.....			1	
Fruit.....	12 feet north of south line Fruit street, on west line Boston road.....			1	
Gorham.....	On street car sprinkler stand pipe, 20.5 feet east of west line Gorham street, 12.7 feet north of north line Ellsworth street.....			1	
High.....	On street car sprinkler stand pipe, 15 feet east of west line High street, 15.5 feet north of north line Porter street.....			1	
*Lawrence.....	14 feet east of west line Lawrence street, 1 foot south of south line Moore street.....			1	
*Lawrence.....	5.7 feet west of east line Lawrence street, 31 feet south of south line Concord River bridge.....			1	
Merrimack.....	On street car sprinkler stand pipe, 26½ feet south of north line Merrimack street, 18.8 feet west of east line John street.....			1	
Merrimack.....	On street car sprinkler stand pipe, 21.8 feet south of north line Merrimack street, 38 feet east of east line Spalding street.....			1	
Middlesex.....	On street car sprinkler stand pipe, 18½ feet south of north line Middlesex street, 10½ feet east of west line Harvard street.....			1	
Nesmith.....	On street car sprinkler stand pipe, 26 feet west of east line Nesmith street, 13 feet north of north line Mansur street.....			1	
†Payne.....	16.3 feet from corner of house No. 414 School street, and 4 feet south of south line School street.....			1	
Payne.....	On fire service to old "Box Shop" 11.7 feet east of building.....			1	
Sarah avenue.....	12 feet west of east line Sarah avenue, on south line Charles avenue.....			1	
Shaw Stocking Co.....	On fire service in yard.....			1	
Shaw Stocking Co.....	On fire service in yard.....			1	
School.....	12 feet east of west line School street, on north line C street.....			1	

*Replaced, 4-inch gates.

†Set previously and not listed.

LOW SERVICE—LIST OF STOP GATES SET DURING 1901.

—Continued.

STREETS.	LOCATION.	4-in.	6-in.	8-in.	20-in.
Tanner	On fire service to Tremont & Suffolk store house, 31½ feet north of south line Tanner street, 10 feet east of east line store house.....		1		
Tanner.....	On fire service to Tremont & Suffolk store house, in yard east of store house. I. V. P.		1		
Tanner.....	On fire service to Tremont & Suffolk store house, in yard east of store house. I. V. P.		1		
Third ave.	15 feet south of north line Third avenue, 30 feet east of west line Mammoth road.		1		
Westford.....	On street car sprinkler stand pipe, 20½ feet south of north line Westford street, 6.8 feet west of east line Robbins street	1			
Westford.....	On street car sprinkler stand pipe, 25.2 feet south of north line Westford street, 11 feet east of west line Bellevue street	1			
Winter	12 feet south of north line Winter street, on east line South street.....		1		
Winter	10.8 feet north of south line Winter street, on west line Gorham street.		1		
Worthen.	On hydrant connection, 12½ feet from hydrant.....		1		
Worthen.	14 feet south of south line Merrimack Mfg. Co. mill yard, 26½ feet west of east line Worthen street....				1
	NOTE :—4" gate taken out Winter street, at Davis street.				

LOW SERVICE—LIST OF HYDRANTS SET DURING THE YEAR 1901.

STREETS.	LOCATION.
Aiken avenue.....	On end of pipe opposite No. 290.
Barton avenue.....	On end of pipe.
Broadway.....	Northerly side, 89 feet east of Shaffer street.
Chase avenue.....	Northerly side, 637 feet west of Mammoth road.
First.....	Hydrant changed from westerly side Simpson street, to southerly side of First street, opposite Simpson street.
Fletcher.....	Hydrant changed from corner Fletcher and Dutton streets, to east side Fletcher street, 23 feet north of Dutton street.
Gorham.....	Hydrant changed from easterly side Gorham street, near Bent's court, to westerly side near Winter street.
Hildreth.....	Easterly side near Town line.
Hudson.....	Hydrant changed from westerly side Bassett street, near Hudson street, to northerly side Hudson street, opposite Bassett street.
Lakeview avenue.....	Westerly side, nearly opposite Lakeview avenue school.
Prince.....	Changed location of Lowry hydrant 10 feet westerly.
Shaw Stocking Co.....	In yard of company about 25 feet from Cholmaford street. (Private.)
Shaw Stocking Co.....	In yard of Company, near Shaw street. (Private.)
Suffolk.....	Easterly side, 55 feet south of Market street.
Suffolk.....	Hydrant changed from corner Suffolk and Fenwick streets, to easterly side Suffolk street, opposite Fenwick street.
Tanner.....	In yard near Tremont & Suffolk cotton store house. (Private.)
Worthen.....	Hydrant changed from southeasterly to northwesterly side, and 65 feet southerly.
Carter place.....	Off Gorham street, 250'-9" of 2" iron pipe.
New.....	Off Ludlam street, 158'-0" of 2" iron pipe.

Report of City Engineer.

OFFICE OF CITY ENGINEER.

LOWELL, MASS., Jan. 1 1902

To the Lowell Water Board:—

GENTLEMEN—I have the honor to submit the
Twenty-ninth Annual Report for the year ending
December 31st, 1901:

PUMPAGE.

Total net pumpage for 1901.....	2,570,000,071 Gals.
Total net pumpage for 1900.....	2,884,274,098 "
A decrease in 1901 of.....	308,900,027 "

CONSUMPTION.

Consumption for 1901.....	2,570,705,994
Consumption for 1900.....	2,881,074,704 "
A decrease in 1901 of.....	304,368,710 "

The greatest quantity pumped in one day was, 9,759,610 gallons, on February 16th.

The greatest quantity pumped in one week was 64,265,036 gallons, February 14th to February 20th.

The pumpage for High Service was 59,087,392 gallons, which is 6,385,302 gallons less than that of last year.

The cost of Low Service Pumpage has been Sixteen Dollars and Twenty-Six Cents (\$16.26) per million gallons, an increase of Two Dollars and Thirty-Six Cents (\$2.36,) per million gallons above that of last year.

The cost of High Service Pumpage has been Twenty-seven Dollars and Twenty-two Cents (\$27.22) per million gallons, an increase of Three Dollars and Eleven Cents (\$3.11) per million gallons above that of last year.

TABLE SHOWING QUANTITY PUMPED EACH MONTH AT THE HENDERSON STATION, DURING THE YEAR 1901.

MONTHS.	PUMPING STATIONS—DRIVEN WELLS				STATION No. 1, WEST BIRTH MARKET				Grand Total	Net Total
	No. 2.	No. 3.	No. 4.	Net Total.	Worth, from High City.	Worth, from Low City.	Months.	Trigle Low Market.		
January.....	72,857,152	15,415,419	161,204,477	949,087,078	109,040,870			100,000,000	4,000,000	4,000,000
February.....	57,100,410	38,411,004	167,119,881	807,081,801	180,000,000	90,000,000		100,000,000	9,000,000	9,000,000
March.....	86,809,228	21,061,206	149,000,700	200,170,871	100,000,000	100,000,000		100,000,000	9,000,000	9,000,000
April.....	95,309,848	419,287	118,474,207	100,201,419	99,871,760	40,000,000		100,000,000	9,000,000	9,000,000
May.....		22,103,207	175,716,021	105,878,818	160,000,000	24,117,000		100,000,000	9,000,000	9,000,000
June.....			225,287,543	225,287,543	212,000,000	1,217,270		212,000,000	9,000,000	9,000,000
July.....			235,160,848	235,160,848	215,000,000	20,000,000		215,000,000	9,000,000	9,000,000
August.....			219,720,768	219,720,768	187,000,000	32,720,768		219,720,768	9,000,000	9,000,000
September.....			201,292,720	210,292,720	183,700,000	26,592,720		210,292,720	9,000,000	9,000,000
October.....			200,200,140	200,200,140	170,000,000	30,200,140		200,200,140	9,000,000	9,000,000
November.....			191,007,076	191,007,076	160,000,000	31,007,076		200,000,000	9,000,000	9,000,000
December.....			200,500,200	200,500,200	170,000,000	30,500,200		200,500,200	9,000,000	9,000,000
Totals.....	704,556,744	92,500,802	2,220,705,656	2,220,705,656	1,700,000,000	520,705,656		2,220,705,656	9,000,000	9,000,000

* Increase in 1901.

Percentage in 1901 = 100.772,000. 0.000,000 100.000,000

TABLE SHOWING SOURCE OF SUPPLY, QUANTITY PUMPED AND COST OF PUMPING, AT
THE SEVERAL STATIONS DURING THE YEAR 1901.

PUMPING STATIONS.	SOURCE OF SUPPLY—WELL WATER.				Totals in U. S. Gallons.	COST.	
	345 driven wells at Pawtucket Boulevard.	90 driven wells at City Farm.	120 driven wells in Chelmsford, Mass.	Distributing mains of Low Service system.		Totals.	Per million gallons.
No. 1 (West Sixth Street).....					2,178,818,435	\$17,674.51	\$ 8.11+
Low Service.....					59,087,392	647.80	10.96+
High Service.....					304,255,744	5,326.55	17.51—
* No. 2 (Cook Wells).....		304,255,744			92,989,892	1,369.65	14.73—
No. 3 (Hydraulic Wells).....			92,989,892		2,229,705,453	17,524.17	7.86—
No. 4 (Boulevard Wells).....	2,229,705,453				4,864,856,916		
Total Pumpage.....	2,229,705,453						
Deduct quantity Pumped Twice at No. 4, Repumped and used at No. 1.....				59,087,392	2,288,792,845		
Repumped by High Service.....							
Net Pumpage.....					2,576,064,071	\$42,542.68	\$16.51+
Exclusive of High Service.....							16.26+
Total Cost of High Service Pumpage.....							27.22+

* Includes 37,750,000 gallons (estimated) pumped from wells at Station No. 3.

~~SECRET~~ - ~~TOP SECRET~~ - ~~SECRET~~

The following is a list of the names of the persons who have been identified as having been in contact with the Soviet Union during the period from 1945 to 1950. The names are listed in alphabetical order of the last name. The names are listed in the order in which they were identified. The names are listed in the order in which they were identified. The names are listed in the order in which they were identified.

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH DUTY ENGINE, FOR EACH MONTH DURING THE YEAR 1901.

MONTHS.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. of water pumped into reservoir per lb. of total coal consumed.	Duty in lbs. 1 ft. high coal used in pumping only; no deduction for ashes or clinkers.	Duty on total coal consumed, no deduction for ashes or clinkers.
January	31	23-53	740-30	452,125	10.18	164.20	169,546,875	5,468,254	655	93,229,143	89,617,479
February	25	22-22	559-15	361,676	10.78	164.17	133,628,135	5,425,125	686	94,431,304	90,887,761
March	23	21-20	490-30	288,084	9.79	164.22	108,631,500	4,697,022	656	96,410,311	91,122,125
April	8	14-56	119-30	70,638	11.11	163.97	29,871,750	3,733,969	576	80,307,926	78,758,473
May	26	22-29	684-30	410,363	11.70	167.45	153,886,125	5,918,697	666	90,997,766	89,372,187
June	30	23-47	713-30	567,865	13.26	163.53	212,949,375	7,068,312	737	101,167,413	100,461,736
July	30	23-03	691-30	570,707	13.76	164.38	214,948,875	7,134,962	701	96,592,867	95,988,367
August	29	22-45	659-45	500,215	12.64	164.09	187,580,625	6,468,297	654	89,370,604	89,370,604
September	29	24-56	665-00	492,600	12.36	164.28	184,725,000	6,369,828	654	90,165,458	89,547,735
October	28	22-32	631-00	454,532	12.01	164.06	170,440,500	6,087,482	601	82,601,358	82,135,577
November	18	21-17	383-00	246,621	10.73	164.05	92,482,875	5,137,917	611	83,496,827	83,496,827
December	20	21-53	437-45	323,612	12.32	163.95	121,364,500	6,067,725	526	71,816,951	71,816,951
Totals and Averages	297	22-29	6675-45	4,748,147	11.85	164.03	1,750,555,125	5,965,135	651	89,799,125	88,994,571

TABLE SHOWING WORK DONE WITH WASHINGTON TUBES
MONTH DURING THE YEAR 1901

MONTH.	No. of days pump- ing	Average No. of pumps per day	No. of pumps per month	Flow per month	Average No. of pumps per day	Average No. of pumps per month	Average No. of pumps per day	Average No. of pumps per month	Average No. of pumps per day	Average No. of pumps per month	Average No. of pumps per day	Average No. of pumps per month
January	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
February	28	10.0	280	10.0	10.0	280	10.0	280	10.0	280	10.0	280
March	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
April	30	10.0	300	10.0	10.0	300	10.0	300	10.0	300	10.0	300
May	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
June	30	10.0	300	10.0	10.0	300	10.0	300	10.0	300	10.0	300
July	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
August	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
September	30	10.0	300	10.0	10.0	300	10.0	300	10.0	300	10.0	300
October	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
November	30	10.0	300	10.0	10.0	300	10.0	300	10.0	300	10.0	300
December	31	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341
Total	365	11.0	341	11.0	11.0	341	11.0	341	11.0	341	11.0	341

**TABLE SHOWING WORK DONE WITH MORRIS ENGINE (BEAM AND FLY WHEEL) FOR
EACH MONTH DURING THE YEAR 1901.**

MONTH	No. of days pumping etc.	Average No. of hours pumping per day	No. of hours pumping per month	No. of strokes made in month	Average No. of strokes made per minute	Average head, including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped p. r. day in U. S. gallons.	No. gals. of water pumped into reser- voir per lb. total coal consumed.	Duty in lbs. 1 ft. high coal used in pumping only; no deduction for ashes or clinkers.	Duty on total coal consumed, no deduc- tion for ashes or clinkers.
January											
February											
March	8	7 07	57-00	35,597	10.41	161.53	11,391,040	1,423,880	418	56,228,064	56,228,064
April	17	13-51	225-30	140,479	9.94	161.34	44,955,220	2,644,311	594	91,951,787	79,810,546
May	7	16-30	115-20	76,389	11.02	162.70	21,447,680	3,492,526	688	100,013,977	86,261,022
June											
July	1	13-00	13-00	7,022	9.00	161.82	2,247,040	2,247,040	328	43,405,360	43,405,360
August											
September											
October	2	12 00	24-00	16,242	11.28	160.77	5,197,440	2,568,720	542	72,676,117	72,676,117
November	2	14-22	28-45	20,446	11.85	160.37	6,042,720	3,271,360	544	72,677,017	72,677,017
December											
Totals and Ave ages	37	12-48	473-45	296,185	10.42	161.64	94,775,200	2,861,600	567	82,477,788	76,358,316

TABLE SHOWING WORK DONE WITH WORKINGMEN WHO ARRIVED FROM FOREIGN COUNTRIES IN THE MONTH ENDING THE 31ST 1901

MONTHS.		No. of days pumping.	Average water pumped per day.	No. of holes pumped per month.	No. of "strake" made per month.	Average No. of strikes made per month.	Average No. of holes per month.	Quantity of water pumped in cu. ft.	Value of water pumped in dollars.
January.	10	17 07	171 15	211 099	90 99	3 000 000	900	10 000 000	10 000 000
February.	10	17 09	171 00	202 046	1 11	2 500 000	900	24 000 000	24 000 000
March.	9	16 13	146 00	146 112	1 21	2 000 000	900	24 000 000	24 000 000
April.	9	12 07	102 00	111 043	1 21	2 000 000	900	24 000 000	24 000 000
May.	9	14 01	172 00	164 115	1 21	2 000 000	900	24 000 000	24 000 000
June.	22	26 00	182 00	182 115	1 21	2 000 000	900	24 000 000	24 000 000
July.	22	26 00	182 00	182 115	1 21	2 000 000	900	24 000 000	24 000 000
August.	22	26 00	182 00	182 115	1 21	2 000 000	900	24 000 000	24 000 000
September.	9	16 13	146 00	146 112	1 21	2 000 000	900	24 000 000	24 000 000
October.	9	16 13	146 00	146 112	1 21	2 000 000	900	24 000 000	24 000 000
November.	9	16 13	146 00	146 112	1 21	2 000 000	900	24 000 000	24 000 000
December.	9	16 13	146 00	146 112	1 21	2 000 000	900	24 000 000	24 000 000

TABLE SHOWING AMOUNT OF COAL USED FOR
WORTHINGTON HIGH DUTY ENGINE AT PUMP-
ING STATION DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pump. ing, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January	1,755	257,140	....	258,895
February.....	200	196,446	1,000	197,646
March.....	3,300	153,358	5,600	162,258
April	700	50,830	300	51,830
May	2,590	230,360	1,600	234,550
June	2,015	286,871	....	288,886
July.....	1,910	303,578	....	305,488
August.....	....	287,031	....	287,031
September.....	1,935	280,494	....	282,429
October.....	800	282,140	800	283,740
November.....	....	151,435	....	151,435
December.....	....	230,884	....	230,884
Totals.....	15,205	2,710,567	9,300	2,735,072

TABLE SHOWING AMOUNT OF COAL USED FOR
WORTHINGTON DUPLEX ENGINE AT PUMPING
STATION DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED			
	For starting fire in lbs.	When pump- ing in lbs.	For banking fire in lbs.	Total per month in lbs.
January.....	.....	.....	.....	.....
February.....	800	60,983	800	62,583
March.....	2,000	87,919	2,200	92,119
April.....	2,080	129,851	800	132,681
May.....	.....	.....	.....	.....
June.....	.....	3,430	.....	3,430
July.....	.....	31,700	.....	31,700
August.....	.....	51,049	.....	51,049
September.....	.....	38,994	.....	38,994
October.....	.....	41,411	.....	41,411
November.....	400	201,421	600	202,421
December.....	1,500	214,018	.....	215,518
Totals.....	6,730	800,808	4,400	871,938

TABLE SHOWING AMOUNT OF COAL USED FOR
MORRIS ENGINE AT PUMPING STATION DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pump- ing, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January.....	....	.....	....	.....
February.....	....	.....	....	.....
March.....	....	27,272	....	27,272
April.....	3,900	65,735	6,100	75,735
May.....	800	33,145	1,600	35,545
June.....	....	.....	....	.....
July.....	....	6,960	....	6,960
August.....	....	.....	....	.....
September.....	....	.....	....	.....
October.....	....	9,582	....	9,582
November.....	....	12,032	....	12,032
December.....	....	.....	....	.....
Totals.....	4,700	154,726	7,700	167,126

TABLE SHOWING AMOUNT OF COAL USED FOR
STEAM ENGINES AT PUMPING STATION
No. 2, DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED.			
	For starting hrs. & lbs.	When running hrs. & lbs.	For breaking hrs. & lbs.	Total month, in lbs.
January		38,455		38,455
February		32,894		32,894
March		40,120		40,120
April		35,542		35,542
May				
June				
July				
August				
September				
October				
November				
December				
Totals		1,473,005		1,473,005

TABLE SHOWING AMOUNT OF COAL USED FOR
 WORTHINGTON ENGINES AT PUMPING STA-
 TION No. 3, DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pump- ing, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January.....	75,915	....	75,915
February.....	150,830	....	150,830
March	94,575	....	94,575
April.....	2,244	....	2,244
May.....	95,840	....	95,840
June.....
July.....
August.....
September.....
October.....
November.....
December.....
Totals.....	419,404	....	419,404

TABLE SHOWING AMOUNT OF COAL USED FOR
KNOWLES ENGINES AT PUMPING STATION
No. 4, DURING THE YEAR 1901.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pump- ing, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January	358,315	....	358,315
February	359,038	....	359,038
March	368,851	....	368,851
April	261,458	....	261,458
May	374,389	....	374,389
June	450,108	....	450,108
July	552,288	....	552,288
August	496,745	....	496,745
September....	506,685	....	506,685
October	462,480	....	462,480
November	415,453	....	415,453
December	493,063	....	493,063
Totals.....	5,098,873	....	5,098,873

**PUMPING STATION No. 1, WORTHINGTON HIGH DUTY
ENGINE—RUNNING EXPENSES FOR THE
YEAR 1902.**

Pay of Engineers and Firemen.....	\$6,918 19
887 939-2000 tons of coal (Cumberland, 1900), at \$4.375....	3,882 68
75 1824-2000 tons of coal (Cumberland, 1901), at 4.251....	321 94
23 1441-2000 tons of coal (Cumberland, 1901), at 4.107....	97 42
38 0668-2000 tons of coal (Cumberland, 1901), at 3.982....	1,514 89
Electric light, January 1 to July 16.....	109 20
Electric light, July 16 to January 1, 1902.....	77 48
Gas for lighting works.....	58 83
468 gallons of cylinder oil, at 0.447+.....	209 29
81.2 gallons of engine oil, at 0.30.....	24 36
43.7 pounds of packing, at 0.788.....	34 45
164.8 pounds of cotton waste, at 0.065.....	10 71
Repairs on engine.....	113 18
Repairs on boilers.....	168 13
Tools and stock.....	9 23
Sundries	69 25
Total	\$13,619 23

Cost of pumping water into reservoir per million gallons, \$7.65—

Cost of pumping water one foot high per million gallons, 0.4 66-100+

PUMPING STATION No. 1, WORTHINGTON DUPLEX
ENGINE—RUNNING EXPENSES FOR THE
YEAR 1901.

Pay of Engineers and Firemen.....	\$1,210 68
186 1654-2000 tons of coal (Cumberland, 1900), at \$4.375...	817 37
9 691-2000 tons of coal (Cumberland, 1901), at 4.241...	39 63
3 326-2000 tons of coal (Cumberland, 1901), at 4.107...	12 99
236 1327-2000 tons of coal (Cumberland, 1901), at 3.982...	942 39
Electric light, January 1 to July 16.....	19 11
Electric light, July 16 to January 1, 1902.....	13 56
Gas for lighting works.....	10 29
81.9 gallons of cylinder oil, at 0.447+.....	36 63
14.21 gallons of engine oil, at 0.30.....	4 26
33.5 pounds of packing, at 0.862+.....	28 88
28.84 pounds of cotton waste, at 0.065.....	1 87
35 pounds of tallow, at 0.045.....	1 57
Repairs on engine.....	32 44
Repairs on boilers.....	29 42
Tools and stock.....	1 62
Sundries.....	12 12
Totals	\$3,214 83

Cost of pumping water into reservoir per million gallons, \$10.59.

Cost of pumping water one foot high per million gallons, 0.06 55-100

**PUMPING STATION No. 1, MORRIS ENGINE — RUNNING
EXPENSES FOR THE YEAR 1901.**

Pay of Engineers and Firemen.....	\$345 91
72 1512-2000 tons of coal (Cumberland, 1900), at \$4.375.....	318 31
10 1614-2000 tons of coal (Cumberland, 1901), at 3.982.....	43 03
Electric light, January 1 to July 16.....	5 46
Electric light, July 16 to January 1, 1902.....	3 87
Gas for lighting works.....	2 94
23.4 gallons of cylinder oil, at 0.447+.....	10 46
14.06 gallons of engine oil, at 0.265.....	3 72
44.78 pounds of packing, at 0.376+.....	16 84
8.24 pounds of cotton waste, at 0.065.....	54
12 pounds of tallow, at 0.045.....	54
Repairs on engine.....	76 50
Repairs on boilers.....	8 41
Tools and stock.....	46
Sundries	3 46
<hr/>	
Total.....	\$840 45

Cost of pumping water into reservoir per million gallons, \$8.87—

Cost of pumping water one foot high per million gallons, .05 49-100.

PUMPING STATION No. 1, HIGH SERVICE ENGINE,
RUNNING EXPENSES FOR THE YEAR 1901.

Pay of Engineers and Firemen.....	\$172 96
64 1694-2000 tons of coal (Cumberland, 1900), at \$4.375.....	283 71
8 821-2000 tons of coal (Cumberland, 1901), at \$4.241.....	35 67
2 1693-2000 tons of coal (Cumberland, 1901), at \$4.107.....	11 69
22 1071-2000 tons of coal (Cumberland, 1901), at \$3.982.....	89 74
Electric light, Jan. 1 to July 16.....	2 73
Electric light, July 16 to Jan. 1, 1902.....	1 94
Gas for lighting works.....	1 47
11.7 gallons of cylinder oil, at 0.447+.....	5 23
2.03 gallons of engine oil, at 0.30.....	61
15.7 pounds of packing, at 0.74.....	11 62
4.12 pounds of cotton waste, at 0.065.....	27
Repairs on engine.....	24 00
Repairs on boilers.....	4 20
Tools and stock.....	23
Sundries.....	1 73
Total...	\$647 80

Cost of pumping water into reservoir per million gallons, \$10.96+

Cost of pumping water one foot high per million gallons, 0.13 13.100.

**PUMPING STATION No. 2, DEANE ENGINES—RUNNING
EXPENSES FOR THE YEAR 1901.**

Pay of Engineers and Firemen.....	\$1,805 00
694 22-2000 tons of coal (Cumberland, 1900), at \$4.375.....	3,036 20
39 350-2000 tons of coal (Cumberland, 1901), at 4.241.....	166 14
3 633-2000 tons of coal (Cumberland, 1901), at 4.152.....	13 72
Electric light.....	84 00
50 gallons of kerosene oil for lighting works, at 0.09½.....	4 63
211.5 gallons of cylinder oil, at 0.427+.....	90 40
5 gallons of engine oil, at 0.25.....	1 25
34 pounds of packing, at 0.86+.....	29 27
43 pounds of cotton waste, at 0.065.....	2 79
12 pounds of tallow, at 0.045.....	54
Repairs on engines.....	45 17
Repairs on boilers.....	33 39
Tools and stock.....	52
Sundries.....	13 38
<hr/>	
Total	\$5,326 55

Cost of pumping water into distributing mains per million gallons,
\$17.51—

PUMPING STATION No. 3. WORTHINGTON ENGINES,
RUNNING EXPENSES FOR THE YEAR 1901.

Pay of Engineers and Firemen.....	\$624 75
209 1404-2000 tons of coal (Cumberland, 1900), at \$3.379.....	708 58
50 gallons of kerosene oil for lighting works at 0.09½.....	4 68
15 gallons of cylinder oil, at 0.42.....	6 30
5.5 pounds of packing, at 0.45....	2 47
Repairs on engines.....	18 30
Repairs on boilers.....	2 38
Tools.....	1 00
Sundries.....	1 24
Total.....	\$1,389 65

Cost of pumping water into distributing mains per million gallons, \$14.73—

**PUMPING STATION No. 4, KNOWLES ENGINES, RUN-
NING EXPENSES FOR THE YEAR 1901.**

Pay of Engineers and Firemen.....	\$5,658 75
1298 226-2000 tons of coal (Cumberland, 1900), at \$4.375...	5,679 24
1251 647-2000 tons of coal (Cumberland, 1901), at 3.982...	4,982 77
800 gallons of kerosene oil for lighting works, at 0.099—...	78 88
323 gallons of cylinder oil, at 0.425—.....	137 25
61.5 gallons of engine oil, at 0.25.....	15 37
2 gallons of lard oil, at 0.55.....	1 10
98.81 pounds of packing, at 0.767+.....	75 80
3 sets of Rollins' metallic packing.....	40 00
Katzenstein's self-acting metallic packing.....	10 94
173 pounds of cotton waste, at 0.065.....	11 24
18 pounds of tallow, at 0.045.....	81
Repairs on engines.....	462 90
Repairs on boilers.....	252 63
Tools and stock.....	33 75
Sundries.....	82 74
<hr/>	
Total.....	\$17,524 17

Cost of pumping water into Conduit per million gallons, \$7.86—

RESERVOIR, BEACON STREET, 1901.

MONTHS.	Depth in Feet.	Quantity in U. S. Gallons.	Temperature in Degrees.	
			Of Water.	Of Air.
January.....	18 32	27,703,295	41 55	25 84
February.....	16 34	24,458,887	37 05	22 30
March.....	19 52	29,705,496	41 73	34 99
April.....	19 23	29,211,986	43 50	45 06
May.....	19 62	29,869,454	46 72	56 06
June.....	19 90	30,347,007	49 06	70 29
July.....	19 66	29,945,183	57 61	75 11
August.....	20 12	30,723,179	64 68	72 45
September.....	19 96	30,452,577	65 75	64 98
October.....	19 36	29,429,865	62 26	51 80
November.....	18 76	28,435,442	56 76	35 12
December.....	18 67	28,291,192	50 44	29 86

TABLE SHOWING THE AVERAGE MONTHLY AND
DAILY CONSUMPTION OF WATER FOR THE
YEAR 1901

MONTHS.	Gallons per month.	Gallons per day.
January	256,264,645	8,266,801
February	253,543,136	9,055,112
March	256,087,751	8,260,895
April	207,422,447	6,914,082
May	203,985,317	6,580,172
June	212,500,266	7,083,342
July	225,473,289	7,263,332
August	209,769,923	6,766,772
September	195,445,161	6,514,839
October	191,681,881	6,183,286
November	172,461,908	5,748,730
December	192,129,500	6,197,726
Totals and Averages	2,576,765,224	7,059,631

SUMMARY OF STATISTICS.

REPORT OF 1901.

In accordance with the recommendations of the New England Water Works Association.

LOWELL WATER WORKS, MIDDLESEX COUNTY, MASS.

Population by census of 1900, 94,969.

Date of construction, 1870 to 1873.

Date of construction, High Service, 1881.

Date of construction, Driven Wells, 1893 to 1902.

Source of supply, two hundred ten (210) driven wells in the valley of River Meadow Brook, and three hundred forty-five (345) driven wells at Pawtucket Boulevard.

Mode of supply, pumping to reservoir and pumping direct.

PUMPING.

1. Builders of Pumping Machinery.

AT STATION NO 1.

One engine, capacity 5,000,000 gallons, in 24 hours, Henry G. Morris.

One engine, capacity 5,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 10,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 500,000 gallons in 24 hours, Henry R. Worthington.

AT STATION No. 2, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, The Dean Steam Pump Co.

One engine, capacity 3,000,000 gallons in 24 hours, The Dean Steam Pump Co.

AT STATION No. 3, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

AT STATION No. 4, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

2. Description of coal used:

(b) Kind, bituminous.

(c) Size, broken.

(d) Brand, Cumberland.

(e) Price per gross ton delivered, \$4.70 +

3. Coal consumed for the year, in pounds, 10,765,478, Low Service, (3,774,196, Station No. 1.)

4. $\frac{\text{Wood consumed for the year in pounds}}{3} = \text{coal in pounds} = 2,400,$
Station No. 1.

5. Total fuel consumed for the year in pounds, 10,767,878, Low Service, (3,767,596, Station No. 1.)

6. Total pumpage for the year, in gallons, 2,576,064,071.
(2,178,818,435, Station No. 1.)

7. Average static head against which pumps work, 156.30, Station No. 1.

8. Average dynamic head against which pumps work, 163.59,
Station No. 1.

9. Number of gallons pumped per pound of coal (5), 239. (577
Station No. 1.)

$$10. \text{ Duty} = \frac{\text{Gallons pumped (6)} \times 8.34 \text{ (pounds)} \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}} =$$

78,712,429, Station No. 1.

COST OF PUMPING FIGURED ON PUMPING STATION EXPENSES OF \$17,674.51,
Station No. 1.

11. Per million gallons raised against average dynamic head (8) into
\$8.11, Station No. 1.
12. Per million gallons raised one foot high (dynamic), \$0.04 96-100,
Station No. 1.

Analyses of water from Merrimack River, Wells at Pawtucket
Boulevard, Pumping Station No. 1, and the Cook and Hydraulic
Well plants, while used as a source of supply, have been made each
month by the State Board of Health, a record of which is annexed.

Respectfully submitted,

GEORGE BOWERS,

City Engineer.

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Merrimack River.
(Parts in 100,000.)

NO.	DATE OF		APPEARANCE.		ODOR.		REACTION ON HYDRATION.			AMMONIA.		CHLORINE.		NITROGEN AS		Iron.	Oxygen Consumed.
	Collection.	Kranz duration.	Turbid- ity.	Sediment.	Color.	Cold.	Hot.	Total.	In 100 parts.	Fixed.	Free.	Total.	In so- lution.	In so- lution.	Nitrogen.	Hydrogen.	
34,570	Jan. 22	1001.	24	Slight.	Slight.	Faintly Unpleasant.	Diastictly Unpleasant.	4.30	1.00	2.30	.0114	.0194	.0180	.0044	.0000	.0001	1.8
34,576	Feb. 26	27	19	Slight.	19	Diastictly Unpleasant.	Decidedly Unpleasant.	4.80	1.00	3.80	.0118	.0228	.0190	.0038	.0110	.0002	1.8
35,248	Mar. 26	27	36	Cons.	36	Diastictly Unpleasant.	Diastictly Unpleasant.	8.40	1.40	2.00	.0086	.0252	.0200	.0032	.0080	.0000	0.8
35,500	April 23	26	33	Cons.	33	Faintly Unpleasant.	Diastictly Unpleasant.	2.00	1.25	1.75	.0012	.0160	.0120	.0040	.0070	.0001	0.8
35,745	May 21	22	54	Cons.	54	None.	Faintly Unpleasant.	3.40	1.00	1.40	.0010	.0214	.0108	.0046	.0080	.0001	0.8
36,117	June 25	26	29	Cons.	29	Faintly Vegetable.	Diastictly Vegetable.	3.70	1.35	1.35	.0018	.0238	.0180	.0080	.0080	.0009	1.0
36,440	July 22	23	23	Cons.	23	Faintly Unpleasant.	Faintly Unpleasant.	4.25	1.00	2.25	.0048	.0222	.0176	.0086	.0080	.0001	1.8
37,301	Aug. 26	20	42	Cons.	42	Faintly Vegetable.	Diastictly Vegetable.	4.25	2.15	2.10	.0080	.0288	.0178	.0080	.0010	.0002	1.8
37,860	Sept. 25	26	27	Slight.	27	Faintly Vegetable.	Diastictly Vegetable.	4.05	2.10	2.25	.0072	.0174	.0104	.0010	.0080	.0008	1.8
37,712	Oct. 23	24	76	Slight.	76	Faintly Unpleasant.	Diastictly Unpleasant.	4.65	2.80	2.15	.0048	.0254	.0210	.0040	.0020	.0008	1.1
38,141	Nov. 26	29	31	Slight.	31	Diastictly Unpleasant.	Decidedly Unpleasant.	4.40	1.70	2.70	.0100	.0180	.0180	.0080	.0070	.0009	1.1
38,456	Dec. 24	26	54	Slight.	54	Faintly Vegetable.	Diastictly Unpleasant.	4.10	1.40	2.70	.0070	.0212	.0178	.0084	.0040	.0000	0.6

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Boulevard Wells.
(Parts in 100,000.)

No.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			Chlorine.	NITROGEN AS		Hardness.	Iron.	Oxygen Consumed.	
	Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on ignition.	Fixed.	Free.	Albuminoid.								
												Total.	In solution.		In suspension.					
34,571	Jan. 22	1901.	None.	Slight Iron.	.06	None.	None.	4.80	....	....	.0064	.0040	....	....	.26	.0140	.0001	2.0	.0230	.07
34,578	Feb. 26		None.	Very Slight Iron.	.10	None.	None.	4.40	...	....	.0034	.0029	...	....	.29	.0240	.0000	2.1	.0100	.05
35,249	Mar. 26		None.	Very Slight.	.00	None.	None.	4.70	....	....	.0040	.0032	....	....	.29	.0770	.0000	2.3	.0250	.05
35,510	April 23		None.	Very Slight.	.02	None.	None.	3.90	....	....	.0052	.0028	....	....	.25	.0170	.0002	2.0	....	.07
35,746	May 21		None.	Very Slight.	.00	None.	None.	4.30	...	....	.0034	.0022	...	....	.26	.0220	.0000	1.8	.0210	.02
36,118	June 25		None.	Very Slight.	.01	None.	None.	3.60	....	....	.0052	.0032	....	....	.20	.0190	.0000	1.4	.0250	.06
36,451	July 22		None.	Very Slight.	.00	None.	None.	4.00	....	....	.0034	.0030	....	....	.24	.0100	.0001	1.7	.0300	.08
37,002	Aug. 28		Very Slight.	Very Slight.	.05	None.	None.	3.30	....	....	.0036	.0034	....	....	.20	.0070	.0001	1.4	.0480	.14
37,390	Sept. 25		Very Slight.	Very Slight.	.02	None.	None.	4.70	....	....	.0020	.0034	....	....	.22	.0070	.0001	1.6	.0180	.10
37,713	Oct. 23		Very Slight.	Very Slight.	.04	None.	None.	4.00	....	....	.0036	.0042	....	....	.23	.0020	.0003	1.7	.0210	.08
38,142	Nov. 28		Very Slight.	Slight.	.02	None.	None.	4.60	...	....	.0036	.0026	....	....	.26	.0100	.0001	1.6	.0160	.08
38,459	Dec. 24		Very Slight.	Slight Iron.	.06	None.	None.	4.50	....	....	.0068	.0038	....	....	.28	.0170	.0000	1.8	.0310	.07

COMMONWEALTH OF MASSACHUSETTS. — STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS. — Pumping Station No. 1.
(Parts in 100,000.)

No.	DATE OF		APPEARANCE.		ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.			Chlorine.	NITROGEN AS		Iron.	Oxygen Consumed.
	Collection	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on igni- tion.	Fixed.	Free.	Albaminoid.		Nitrates.	Nitrites.		
34,981	Feb. 26	1901.	Very Slight.	Very Slight.	.00	None.	None.	4.70	...	....	.0026	....	.31	.0320	.0000	2.0	.0090 .06
35,717	May 21		Very Slight.	Slight Iron.	.01	None.	None.	4.20	....	...	.0018	....	.31	.0646	.0001	2.3	.0220 .02
36,119	June 25		None	None.	.00	None.	None.	4.90	....	...	.0028	....	.23	.0389	.0000	1.6	.0140 .07
36,450	July 22		None.	Very Slight.	.00	None.	None.	4.20	....	....	.0022	....	.26	.0130	.0002	1.4	.0210 .07
37,003	Aug. 28		Very Slight.	Very Slight.	.02	None.	None.	3.60	....	....	.0014	....	.23	.0160	.0001	1.7	.0180 .08
37,391	Sept. 25		None.	Very Slight.	.01	None.	None.	4.40	....	....	.0048	....	.24	.0180	.0001	1.6	.0070 .06
37,714	Oct. 23		None.	Very Slight.	.01	None.	None.	4.20	....	....	.0018	....	.25	.0080	.0003	1.8	.0110 .09
38,143	Nov. 28		Very Slight.	Very Slight.	.01	None.	None.	4.00	....	....	.0014	....	.28	.0200	.0000	1.7	.0000 .09
38,400	Dec. 24		None.	Very Slight.	.02	None.	None.	4.60	....	....	.0040	....	.29	.0230	.0000	1.8	.0070 .06

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Cook and Hydraulic Wells and Cook Wells.
(Parts in 100,000.)

No.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.			NITROGEN AS		Iron.	Oxygen Consumed.			
	Collec- tion.	Exam- ination.	Turbid- ity.	Sediment.	Color.	Cold	Hot.	Total	Loss on Heat.	Free.	Total	In so- lution.	In sus- pension.	Chlorine.			Nitrates.	Nitrites.	Hardness.
34,572	Jan. 22	1901. 24	Slight.	Cons. Iron.	.14	None.	None.	9.50	....	.0016	.0002	....	....	.50	0.350	.0000	3.5	.0780	.09
34,886	Feb. 26	27	None.	Very Slight.	.00	None.	None.	8.50	....	.0016	.0036	....	....	.57	.0760	.0000	3.6	.0710	.08
35,250	Mar. 26	27	Very Slight.	Slight.	.07	None.	None.	9.20	....	.0054	.0048	....	....	.48	.0400	.0001	4.0	.0750	.09
35,511	April 23	25	Very Slight.	Very Slight.	.08	None.	None.	8.00	....	.0044	.0052	....	....	.48	.0410	.0001	3.8	.0720	.09

THIRTIETH
ANNUAL REPORT

OF THE



LOWELL WATER BOARD

TO THE

City Council of the City of Lowell, Mass.

AND THE

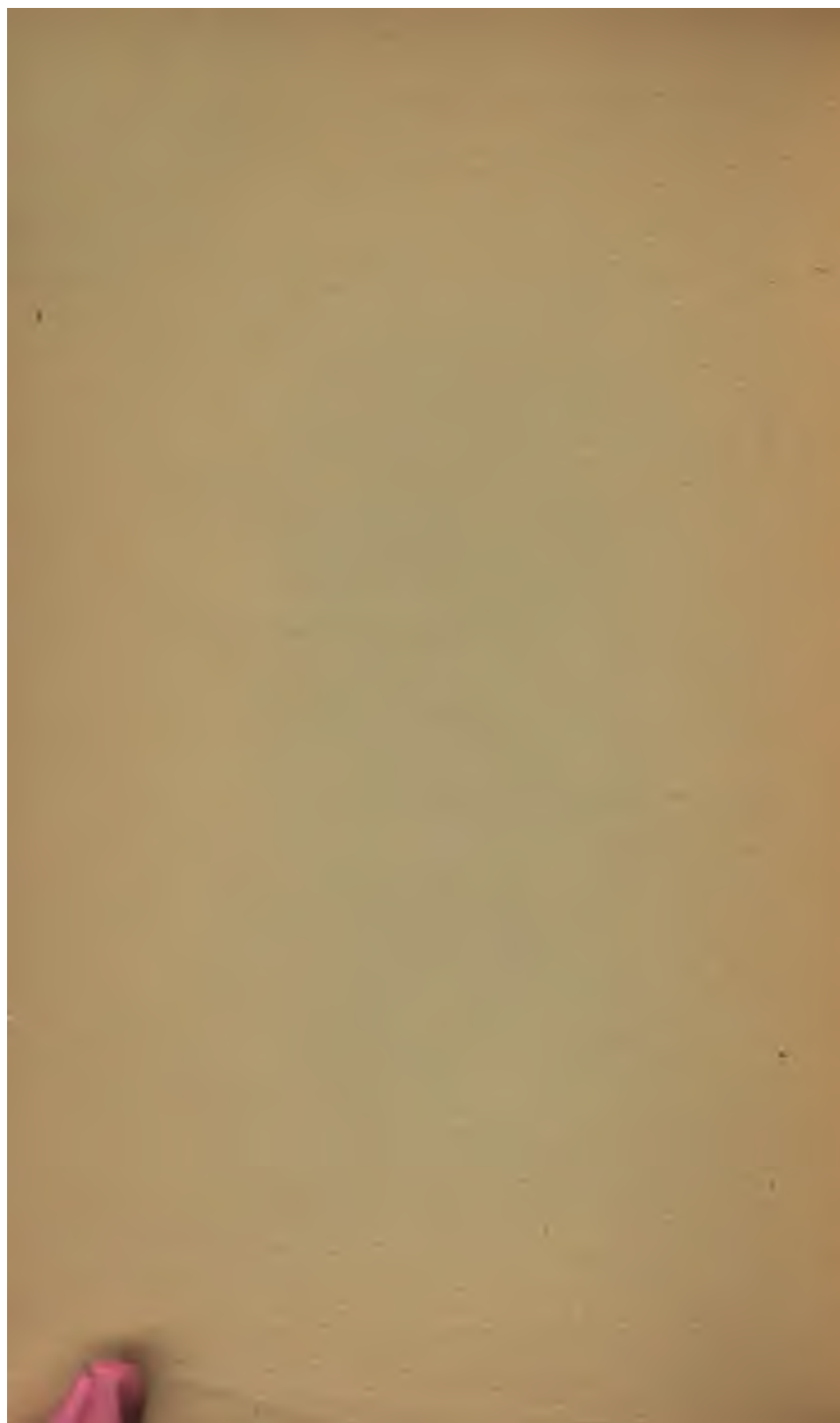
Reports of the Superintendent of Water Works and of
the City Engineer to the Water Board for 1902.



LOWELL, MASS.:
THE LIBBY PRINTING COMPANY.
1903.

THE NEW YORK
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LOWELL, MASS. AND
THE WATER BOARD
1903

VIIA



THIRTIETH
ANNUAL REPORT
OF THE
LOWELL WATER BOARD

TO THE
City Council of the City of Lowell, Mass.

AND THE
Reports of the Superintendent of Water Works and of
the City Engineer to the Water Board for 1902.



LOWELL, MASS.:
THE LIBBY PRINTING COMPANY.
1903.

PL 428

903

CITY OF LOWELL.

IN BOARD OF ALDERMEN,
February, 1903.

Received and ordered on file. Sent down for
concurrence.

GIRARD P. DADMAN,
City Clerk.

IN COMMON COUNCIL,
Received and ordered on file in concurrence.
FRANK M. DOWLING,
Clerk.

WATER DEPARTMENT, 1902.

WATER BOARD.

FRANK L. WEAVER, President.

Term expires second Monday in March, 1904

MICHAEL J. DOWD,

Term expires second Monday in March, 1905.

AUGUST FELS,

Term expires second Monday in March, 1906.

HERBERT C. TAFT,

Term expires second Monday in March, 1903.

JOHN W. CRAWFORD, Secretary and Clerk.

ROBERT J. THOMAS, Superintendent.

GEORGE BOWERS, City Engineer.

D. B. H. BARTLETT, Engineer.

THOMAS McLOUGHLIN, Engineer.

JOHN B. HENRY, Keeper Reservoir.

THOMAS F. DOYLE, Foreman.

WILLIAM JOYCE, Assistant Foreman.

JOHN E. LOWNY, Meter Inspector.

ALBERT HALLOWELL, Foreman Shop.

A. F. COGER, Hydrants and Gates.

THOMAS ROGERS, Services.

OFFICE.

GEORGE E. WORTHEN, Service Clerk.

GERTRUDE W. BYAM, Bookkeeper.

JULIA J. RAFTER, Assistant Bookkeeper.

INSPECTORS.

ROBERT GARDNER.

FREDERICK A. BARON.

MICHAEL H. McCUE.

GEORGE F. TILTON.

WALTER P. WILEY.

Report of the Water Board.

OFFICE OF THE WATER BOARD }
CITY HALL. }
LOWELL, MASS., Jan. 1, 1903. }

*To His Honor the Mayor and the City Council of
the City of Lowell :*

The Water Board of the City of Lowell herewith respectfully submits its report for the year ending December 31st, 1902.

On May 21st occurred the death of our honored Mayor, Hon. Charles A. R. Dimon, who was a member of the Water Board in 1884, '85; '86 and 1887 and served as President of the Board in 1887. On May 23rd the following resolutions to his memory were adopted by the Water Board, and it is fitting that they should be given a place in this report as a testimonial to his worth, and a record of our appreciation of him as a citizen.

RESOLUTIONS.

The Lowell Water Board, with profound sorrow, unite with their fellow citizens in deploring the death of Charles A. R. Dimon, Mayor of the City of Lowell and formerly a member of this Board for four years and its President for one year, and appreciating his worth as a gallant soldier whose early manhood was given to the nation to assist in the preservation of the Union and the perpetuation of freedom; as a public official honored by his fellow citizens of Lowell in various positions of trust, including the highest office in their gift, and bringing to those offices a conscientious devotion to duty, an unimpeachable honesty, and a thorough business training which rendered his services invaluable; as a private citizen foremost in every work of benevolence and charity to whom the poor and the suffering looked as a true friend, we do hereby tender to his bereaved family our sincere sympathy and express our sorrow for the loss they and the municipality have sustained by his death.

Resolved: That these resolutions be entered upon the records of this Board and that a copy be sent to the family of the deceased.

(Signed)

FRANK L. WEAVER,
AUGUST FELS,
MICHAEL J. DOWD,
HERBERT C. TAFT.

The most important work of the year has been the extension of 10" pipe in Princeton Street to the City line 3168 feet, also connecting a number of short streets in that locality with 6" pipe. The cost of this amounted to \$5,874.89 although the 10" pipe was purchased some years ago for this

REPORT OF THE WATER BOARD.

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purpose and did not come out of this year's revenue. The Board was influenced to make this extension this year from the fact that every year for the last five years there has been a petition presented praying for this extension from the people living in Dingwell, Carey and Cashion Streets and the extension seemed to the Board a necessity that the residents in that part of the City were entitled to.

The suction mains at the Cook plant have been lowered so as to prevent their freezing, thus obviating the necessity of pumping water during the winter to prevent the freezing and consequent damage and uselessness of the plant if suddenly called into use in emergency.

The scarcity and high price of coal has been a question of anxious concern during the year and in one or two instances the outlook was most serious with only twenty-four hours' supply in sight, but sufficient coal was obtained to keep the plant running through the stringency, the extra expense to the department for fuel this year over last year will reach nearly Five Thousand Dollars.

The work of the department has been continued on the same general lines as heretofore and a study of these reports will show that it has been our aim to promote the permanency and efficiency

of the plant towards a more economical working as it increases in magnitude.

The Secretary's report shows total receipts of \$197,256.58, a decrease of \$3,841.87, and expenditures of \$208,400.99, a decrease of \$12,543.68 from last year, leaving a balance of \$7,165.19, a decrease of \$11,144.41. The charges for water decreased \$19,617.14 for which the large number of meters added last year is mainly responsible; also the consumption of water is the lowest for ten years. The financial transactions, the work of construction and maintenance and the details of pumping are fully set forth in the reports of the Secretary, Superintendent and Engineer, to which you are respectfully referred.

The last annual installment of \$10,000.00 on the first driven well loan of \$100,000.00 for driven wells in 1892 was paid during the year and the total debt on Water Works was reduced \$31,600.00 leaving total debt at \$1,205,500.00.

The charges for metered water are 79% of the whole, while the water through meters is only 34% of the total amount used. Of the 923 City meters set in 1901, 377 have been purchased 123 places have been put on faucet rates and 426 are still on metered rates as City meters but all who show a less rate by meter will be invited to purchase the meter or they will be charged faucet rates.

During the early part of the year the people of North Chelmsford secured the passage of an Act through the legislature, empowering the City of Lowell to furnish the Town of Chelmsford with water; the people of Dracut also obtained a similar Act, both Acts being passed within a short time of each other.

Following the passage of these Acts, petitions were presented to the City Council that water be furnished the villages of No. Chelmsford and the "Navy Yard" in Dracut, and a Committee consisting of Aldermen Barton and Brown and Councilmen Laporte, Brown and Welch were appointed to act in conjunction with the Water Board to whom was referred these petitions; hearings were had for each party, but no report has been made to the City Council by the Committee of the same, and the matter stands in abeyance.

FRANK L. WEAVER,
MICHAEL J. DOWD,
HERBERT C. TAFT.
AUGUST FELS.

LOWELL WATER WORKS OFFICE.

[JANUARY 1, 1903.

TO THE LOWELL WATER BOARD:

Gentlemen:—Herewith I submit figures detailing the finances of the Lowell Water Works for the year ending December 31st, 1902.

J. W. CRAWFORD, Clerk.

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1902.

TABLE I	CHARGES.					RECEIPTS				
	WATER.			Other than Water	Total Charges 1902	Total Charges 1901	By Accounts			
	Rate	Metered	Total				Receipts	Discounts	Abatements	Due
Transfer					44,066 64	34,639 92	36,960 02	3,850 18	1,955 37	1,301 07
Feb.	47 22		47 22	1,287 25	1,334 47	1,767 28	1,231 37	5 08		98 02
Mar.	38,858 85	36,126 86	74,985 71		74,985 71	83,903 33	66,047 46	7,475 73	1,267 92	194 60
Apr.	418 84		418 84	3,974 38	4,393 22	1,573 23	4,042 03	38 03	73 52	239 64
May	25 00		25 00	2,371 16	2,396 16	2,520 08	2,258 71	2 50	19 85	115 10
June	3,073 18	53,262 47	56,335 65	1,567 53	57,903 18	56,072 41	50,559 01	5,361 35	102 84	1,879 98
July	410 37		410 37	1,442 14	1,852 51	1,539 57	1,602 25	8 92	2 00	239 34
Aug.	191 38		191 38	1,254 89	1,446 17	1,272 69	1,311 07	17 31	25 47	92 42
Sept.	129 06	35,432 13	35,561 19	939 00	36,500 19	43,996 79	31,502 27	3,410 57	25 47	1,561 88
Oct.	139 59		139 59	2,049 12	2,188 71	3,680 94	1,057 02	11 07		1,120 62
Nov.	85 08		85 08	1,965 28	2,050 36	1,379 97	217 07	3 37		1,829 92
Dec.	383 27	31,564 86	31,948 13	606 52	32,554 65	36,591 81	465 62	17 66		32,071 37
TOTALS	43,761 84	156,386 32	200,148 16	17,457 27	261,672 07	268,938 02	197,253 90	20,201 77	3,472 44	40,743 96

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1902.
OUTGO.

TABLE II	Pay Roll and Salaries	Water Works Supplies	Interest and Principal	Refund and Vacancies	General Expense Account	Stable	Fuel	New Wells	TOTAL.	
									1902	1901
Jan.	4,494 57	3,058 65	540 00	39 59	160 44	14 48		25 41	7,933 14	4,534 69
Feb.	5,228 83	1,452 83	2,852 50	4 65	92 58	114 72	1,087 93	1,087 00	12,421 04	13,996 86
Mar.	6,259 58	1,205 23		80 95	372 85	27 17	183 69	72 00	8,201 47	16,648 67
Apr'l	5,650 04	2,549 30	120 00	136 09	111 32	92 69	2,318 33	524 90	11,502 67	8,200 99
May	7,748 33	1,156 57	18,772 00	542 00	189 31	146 16	507 44		29,061 81	29,110 70
June	6,611 40	3,497 40	2,580 00	52 81	328 29	77 26	1,870 63		15,017 79	11,044 39
July	5,793 09	4,331 95	18,320 00	107 74	143 74	295 58	3,468 54		32,460 64	28,761 62
Aug.	7,458 02	2,246 98	2,592 50	115 13	401 35	36 79	31 37		12,882 14	18,645 68
Sept.	5,969 93	1,141 19		121 51	148 44	60 34	1,878 38		9,319 79	11,867 49
Oct.	5,957 44	3,569 95	4,140 00	180 36	135 61	33 67	2,886 21		16,903 24	18,134 16
Nov.	7,270 66	1,922 22	30,572 00	66 93	217 20	14 33	2,055 35		42,118 69	41,621 07
Dec.	5,985 99	1,229 62	520 00	131 36	282 66	200 21	2,228 73		10,578 57	18,278 35
TOTAL S.	74,427 88	27,361 89	81,009 00	1,579 12	2,583 79	1,213 40	18,516 60	1,709 31	208,400 99	220,944 67

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1902.
SUBDIVISION OF "OTHER THAN WATER CHARGES" FROM TABLE I.

TABLE III.	Meters Sold.	Expense Setting Meters.	Repairs of Meters	New Services	Changed Services	Labor and Material	Building Charges	Shut off Fines	Interest	TOTAL	
										1902	1901
Feb.	735 00	82 20	195 26	107 20	5 15	134 86	23 58	4 00		1,287 25	1,739 91
Apr.	2,564 00	543 28	71 51	216 40	41 10	108 89	13 20	16 00		3,974 38	1,139 81
May	1,413 50	235 16		405 72	31 60	285 18				2,371 16	1,614 06
June	772 50	99 27	47 81	377 58	16 05	202 06	48 26	4 00		15,67 53	1,092 85
July	799 50	114 58	77 49	258 15	11 15	143 81	17 46	20 00		1,442 14	1,117 40
Aug.	559 00	87 66	44 21	156 15	66 85	261 86	35 16	4 00		1,254 89	1,090 61
S pt.	277 00	39 78	27 48	126 00	7 45	218 87	8 42	4 00	230 00	939 00	1,536 46
Oct.	620 25	114 67	45 15	214 56	44 88	991 37	18 24			2,049 12	2,624 76
Nov.	433 00	54 82	44 85	151 35	31 03	1,245 23		2 00		1,965 28	1,333 85
Dec.	115 50	20 84	105 75	18 60	3 75	295 44	2 64	14 00		606 52	1,243 09
TOTALS,	8,759 25	1,392 26	659 51	2,034 71	259 01	3,887 57	166 96	68 00	230 00	17,457 27	14,532 80

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1902. SUBDIVISION OF "PAY ROLL AND SALARIES" FROM TABLE 2.

TABLE IV	Salaries	Meter Work	Office and Inspectors	Extension and Con- struction.	Engineer- ing	PUMPING STATIONS				Services	Recharged	New Wells	Mainten- ance	TOTALS	
						No. 1	No. 2	No. 4	No. 5					1902	1901
Jan.	283 32	366 36	601 75	68 48		517 92	302 89	445 56		15 11			1,893 91	4,211 25	3,354 59
Feb.	283 36	315 75	671 40	76 70	346 17	597 47	32 319	498 57		22 88			2,092 64	4,599 30	3,769 10
Mar.	283 32	268 75	843 25	230 94	102 50	729 09	269 50	674 45	18 00	80 86		279 53	2,479 38	5,873 76	5,485 95
Apr.	283 32	226 83	675 40	494 59	100 00	626 72	57 25	499 29	90 75	178 07	33 69	845 71	1,538 42	5,266 72	5,290 25
May	283 32	258 39	851 89	1,475 56	125 00	821 65	110 78	500 30	147 50	353 73	31 50	381 28	2,407 43	7,340 01	5,507 76
June	283 36	213 13	683 04	1,319 00	100 00	632 97	60 75	357 54	172 00	259 21			2,530 40	6,228 04	7,327 93
July	283 32	177 87	683 04	642 54	125 00	596 79	58 50	510 29		177 63			2,538 11	5,384 77	5,807 41
Aug.	283 32	268 10	853 80	923 12	105 50	841 43	201 15	651 80	2 00	267 26			3,060 54	7,069 20	6,687 85
Sept.	283 36	208 51	683 04	235 68	100 00	621 52	355 01	517 04		173 60	83 02		2,709 15	5,586 57	4,854 68
Oct.	283 32	176 38	683 04	802 44	125 00	684 78	199 88	435 04		257 60	236 48		2,073 48	5,549 12	5,810 60
Nov.	283 32	218 94	853 80	356 55	100 00	811 47	436 76	589 30		232 72	52 24		3,335 56	6,887 34	7,167 80
Dec.	283 36	293 78	778 20	129 82	50 00	742 80	251 51	652 88		29 58	24 50		2,749 56	5,652 63	5,656 10
TOTALS	3,400 00	2,993 07	8,861 65	6,755 42	1,379 17	8,224 61	2,627 87	6,331 06	430 25	2,048 25	461 43	1,506 52	29,408 58	69,648 71	66,860 04

TABLE V.
FINANCIAL STATEMENT—LOWELL WATER
WORKS 1902.

SUBDIVISION "WATER WORKS SUPPLIES" FROM TABLE 2.

Pumping Station Supplies (Centralville Sta)	\$1,403 85
" " " (Cook Plant Sta)	2,518 64
" " " (Boulevard, Lower Sta.)	1,252 37
" " " (Boulevard Upper Sta)	433 42
Cast Iron Pipe and Specials,	4,017 55
Hydrants and gates and gate boxes,	3,546 26
Service pipe and service boxes,	2,764 38
Meters,	6,041 34
Machinery and tools,	391 64
Brass Foundry,	355 71
Miscellaneous,	3,258 47
	<hr style="width: 10%; margin: 0 auto;"/> \$25,983 53

TABLE VI.
FINANCIAL STATEMENT—LOWELL WATER
WORKS 1902.

DETAIL OF "PRINCIPLE AND INTEREST" FROM TABLE NO. 2.

	Amount at Debt Jan. 1, 1902.	Rate	Interest Paid 1902	Principal Paid 1902	Amount of debt Jan. 1, 1903.
Water loan bonds,	\$1,000,00 00	4			1,000,000 00
2 Coupons No. 20, Nov. 1, 1900,			40 00		
61 Coupons No. 22, Nov. 1, 1901.			1,220 00		
995 Coupons No. 23, May 1, 1902,			19,900 00		
942 Coupons No. 24, Nov. 1, 1902,			18,840 00		
High service bonds,	75,000 00	4			75,000 00
15 Coupons No. 41, May 1, 1902,			1,500 00		
15 Coupons No. 42, Nov. 1, 1902, NOTES			1,500 00		
Lowell Inst. Savings,	10,000 00	4	400 00	10,000 00	
" " "	15,000 00	3½	525 00	5,000 00	10,000 00
" " "	24,600 00	4	984 00	4,100 00	20,500 00
Sundry Persons,	45,000 00	4	1,800 00	5,000 00	40,000 00
Estabrook & Co.,	67,500 00	4	2,700 00	7,500 00	60,000 00
	\$1,237,100 00		49,409 00	31,600 00	1,205,500 00

TABLE VII.
FINANCIAL STATEMENT—LOWELL WATER
WORKS 1902.

MAINTENANCE AND CONSTRUCTION STATEMENT.

MAINTENANCE.

Paid for labor :

Salary of Superintendent	\$ 1,800 00
Salary of Water Board	1,600 00
Office and Inspectors	8,861 65
Pumping Stations	17,613 79
Meter Work	2,993 07
Engineering	1,325 46
General Maintenance	29,408 58

Paid for Material :

Out-put as per stock book	1,480 80
General Expense and Miscellaneous supplies	5,842 26
Stable	1,213 40
Machinery and Tools	747 35
Pumping Station Supplies	5,608 18
Fuel	18,516 60
Interest	49,409 00
	\$146,420 14

CONSTRUCTION.

Paid for labor	\$ 8,803 67
Paid for material	
Out-put as per stock book	14,305 86
New Wells	1,709 31
Electric plant P. S. 4	682 88
Principle payments on notes	31,600 00
	\$57,101 72

Superintendent's Report.

LOWELL, MASS., January 1st, 1903.

To the Lowell Water Board:—

GENTLEMEN:—As required by the City Ordinances, I herewith present to Your Honorable Board the Superintendent's Annual Report of the condition of the Water Works for the year 1902.

All things considered, the real estate, buildings, machinery and other property of the Water Works Department are in good condition. This is especially gratifying when due allowance is made for the magnitude and character of work involved in the last ten years in changing over entirely the source of the City's water supply from the condemned Merrimack River water to Driven Wells; and if the financial showing of the Department is not as good as in some years past, it should be borne in mind that not only is the cost of the new supply, both principal

and interest, being met by the revenues from the Works, but the complicated nature of the supply has materially increased the cost of operation and maintenance. Furthermore, a ten per cent. discount is annually made on all water bills and a still further reduction in the revenues has been caused of late years by the failure of the City Council to appropriate money for hydrants or fire protection. Today the Works are equipped so the people of the City can at all times depend upon an ample supply of excellent water for all purposes, sufficiently soft for all domestic and manufacturing uses, yet pleasant and wholesome for drinking. Later on, now that a satisfactory supply is assured, attention can be given towards improving the System with a view of lessening the running expenses. In this line was the work of lowering the suction pipes at the Cook Wells.

COOK WELLS.

Lowering the suction lines at this plant was probably the most important undertaking of the Department during the past year. It was begun early in the year and followed up from time to time when the level of the water in the Brook and the weather permitted, which was at rare in-

tervals owing to the extraordinary wet weather of the summer and fall. Yet while these unfavorable conditions tended greatly to increase the cost and retard the completion of the work, by running the pumps in the Station, discharging the water in the Brook below the Well plant, sufficient progress was made by the end of the year to allow the shutting down of the Station without danger to the pipes from freezing. In fact, by far the most difficult and expensive part of the work is accomplished; what remains being mostly a matter of connecting some of the lateral pipes to the main suction and attaching about twenty wells. During the progress of lowering the lines the wells were thoroughly cleaned. Cost of this work to date, \$2,426.39.

The contract with Joseph Jalbert for building brick chimney 80 ft. high, 42 in. core at this station was completed in a very satisfactory manner. Connecting with the chimney, new uptakes and a new flue were furnished and erected in position by Scannell & Wholey, after which the brick flue that connected with the old smoke stack was removed. Cost of chimney \$803.00. New uptakes and flue \$458.00.

HYDRAULIC WELLS.

The building which did duty as a Pumping

Station at the Hydraulic or Washington Wells was sold to Malcolm Brown and removed during the year. The place where it stood was filled in and graded. I would recommend that during the coming year a small brick house be built over the gates near the site of the old Station to mark their location and also for convenience in operating them and as a safeguard from outside interference and damage. The post hydrant put in for fire service at this Station was replaced after the building was taken down by a flush hydrant to be used for flushing the 20" main when required.

If the contingency should arise the Cook Wells Pumping Station can be started any day and between three and four million gallons of water pumped from the Cook and Hydraulic wells into the city mains. By keeping these wells cleaned and the Cook Wells Pumping Station in order, this amount of water will always be available and some day may prove of great benefit; it would at any rate remove all fears of a scarcity of water in case of a temporary interruption of the Boulevard supply.

LOWER BOULEVARD STATION.

The Lower Boulevard Pumping Station proved

its capacity for supplying all the water used by the city the past year. In fact, it did all the pumping last year except the week it was shut down to permit the cleaning of the Gallery and Conduit and when the two Boulevard Stations were run for a few days to test the quantity of water that could be obtained with both Stations pumping and another time when the Upper Station was operated alone in order that certain repairs could be made on the piping, which together with the boring out of the steam cylinders on No. 1 pump, was the only repairs of any account made at this Station. All three of the main pumps there now have 12" Steam Cylinders. A new platform and stairs were built to take the place of the old dilapidated structure that was there from the time the Station was built. The Forbes Engine and Bullock Dynamo used for lighting the two Stations and the houses belonging to the Department gave good service since they were repaired in March.

UPPER BOULEVARD STATION.

The new Pumping Station on the Boulevard was started for the first time on the 26th day of March and continued running in conjunction with the Lower Station until the 29th, both de-

livering about twelve million gallons of water per twenty-four hours into the conduit. The pumps ran very smoothly and everything about the station, inside and out, showed up well. The grading of the grounds was finished early in the year. A 4" pipe from the city main was put in the building for a fire service and for other uses. No more expense will be needed at this Station for years to come. The 20" force main from the Upper Station and the 24" main at the Lower Station were connected during the year.

CONDUIT, GALLERY AND TUNNEL.

From October 28th to November 1st, inclusive, pumping was stopped at the Boulevard and Centralville Stations for the purpose of cleaning, flushing and inspecting the Gallery, Conduit and Tunnel. The inspection developed no material change in their condition. Besides the usual flushing of the conduit through the 30" blow-off at Beaver Brook, all the brickwork was scrubbed clean and by the use of 700 feet of fire hose attached to a near-by hydrant, the Tunnel was thoroughly washed. During the same week the pump well at the Centralville Station and the

REPORT OF THE WATER WORKS.

21

THE WATER WORKS, CONNECTING THE TOWN OF NEW YORK
TO THE CITY OF NEW YORK, AND THE CITY OF NEW YORK

REPORT OF THE WATER WORKS.

THE PUMPS AND OTHER MACHINERY OF THE
STATION ARE VERY WELL THE PAST YEAR. THE
ENGINE HAS RUN WELL AND THE PUMPS HAVE
AT ALL TIMES SINCE I WAS PLACED IN CHARGE
GIVEN SOME trouble especially at the water
the valve mechanism was much broken and had to
be repaired the water is very and very hot
the bucket in place were much in such a condi-
tion that new ones had to be purchased in their
place. The only repairs made on the steam end
was the changing of the position of eccentric rods
and cross head between the eccentric and valve
motion; this change improved the running of the
engine considerably.

The Low Duty Worthington was run but very
little and received no repairs. The High Duty
Worthington as usual was the main reliance of
this Station, doing, as it has done for the past
ten years, the greater part of the pumping there.
No repairs were made on it during the year, but
one of the compensating cylinders is now in bad
condition and will have to be replaced by a new

one before long. A new cylinder is in stock ready for use as are also two new plungers for the compensating cylinders. The plungers were made in the Department Shop but the cylinder came from the H. R. Worthington Shop.

At the request of Mr W. O. Teague, of the graduating class of the Institute of Technology, he and his fellow students were allowed to make a test of the High Duty Worthington. It was the first test since one made preliminary to its acceptance by the City ten years before.

Following is a comparison of the results obtained at both tests:

	1892.	1902.
Duration of test	10 hrs.	24 hrs.
Number of revolutions per minute	20.86	18.67
Steam pressure carried	96 lbs.	93.66 lbs.
Temperature of feed water	106 dgs.	94.518
Coal consumed per sq ft. of grate	9.79 lbs.	9.82 lbs.
Water evaporated per lb. of coal	9.31 lbs.	9.32 lbs.
Coal used per Ind. H. P.	1.69 lbs.	1.84 lbs.
Duty based on 1,000,000 heat units	116,208,007 ft. lbs.	93,004,400 ft. lbs.
Capacity in 24 hrs. plunger displacement	11,345,141 gals.	10,026,750 gals.
Percentage of slip	4.1 pr ct.	4.43 pr ct.

A marked reduction is shown in the duty since the first test, but probably no more than might

to be susceptible to rapid changes in elevation and the same to be free from wave action. This stand pipe is set in the efflux chamber between the screens and the reservoir, thereby ensuring a correct reading of the height of the water at all times. Placed in the stand-pipe is a float connected with a large pulley while a counter weight is similarly connected to a small pulley and both are fastened by a screw to shaft of transmitter, which apparatus mechanically transmits the changes electrically to the receiver at the Pumping Station. Installed at the same time were three Couch and Seeley telephones; one at the keeper's residence, one at Gate House and one at the Centralville Pumping Station. The N. E. Tel. & Tel. Co. furnished the cross arms, etc., and ran the five lines of wire necessary in a most satisfactory manner on poles owned by the Company on Hampshire, West Ninth, Bridge and Sixth Streets to the Gate House, Beacon Street.

EXTENSION OF MAINS AND GATES.

The distributing mains were extended during the year 13,368.5 ft., an increase over the amount laid the previous year of 4,976.5 ft. The principal extension was that of 3,200 ft. of 10" pipe

from terminals on Princeton Street westerly to Chelmsford Town Line. This pipe, in connection with the 8" main on Hildessex Street, is of sufficient size to supply the whole village of North Chelmsford with water for all purposes in the event of the City's agreeing to do so.

Another long extension was that of 834 ft. of 6" pipe from Fowler road to the Boulevard. On this extension is set a hydrant to be available in case of fire in either of the Department houses or the Upper Boulevard Pumping Station. As a further measure of fire protection for this Station, fire connection is made with the above extension.

For several years the operation of the Boston & Maine R. R. Stand-pipe supplied from the a main on Meadowcroft Street was at times the cause of more or less annoyance and damage to the water takers on that street, due primarily to the fact that the main was too small and that it formed a dead end a little beyond Lundberg St. During the year, owing to the construction of a sewer, a large section of this line had to be removed temporarily in order to do this and at the same time give the houses and mills on that street water. Upon the sanction of your Honorable Body an 8" main was laid on Lundberg St. between Potter and Meadowcroft Streets, connect

ing with the pipe formerly laid on the Lundberg Street bridge when it was constructed. After the sewer was completed, the 6" pipe removed was replaced with 8", thus relieving the condition of affairs there by enlarging the main and giving circulation through from Moore Street to Gorham Street.

Fifty-four stop gates were added during the year, making a total now in use of 1289.

Number of gates repacked	95
Number of gates repaired	57
Number of gate boxes renewed	31
Number of gate boxes repaired	11

FIRE SERVICES, HYDRANTS, ETC.

Notwithstanding the refusal of the City Council to appropriate any moneys raised from general taxation to meet the increased cost of the Water Works on account of fire protection, every place where a hydrant could be set to advantage it was done so; not only was this done for public use, but every application for private fire service was granted. In the latter cases the expense of laying pipes, etc. was borne by the owners of the premises so protected, but nothing is paid

towards the maintenance of these services, nor for the water used, the expense of inspection, nor the rights thus obtained; and furthermore, these services are not metered. The matter of charging for private fire protection is being considered by the various Water Works Associations throughout the country with a view of establishing an equitable rate for the important services given by cities or Water Companies to private concerns and corporations. They are also agitating the use of some measuring device or meter in order that leakage or the use of water for other than fire purposes may be detected.

The following fire connections were made during the year:

Bateman's Mill.	Fulton St.,	4" Pipe.
Mass. Mohair Plush Co.	Western Ave.,	6" Pipe.
Lowell Gas Light Co.	Perrin St.,	4" Pipe.
Textile School.	Falmouth St.,	8" Pipe.

A new 6" check valve was set and other alterations made on Fire Service of Boston & Northern St. Railway Co., Middlesex Street, for their Power Station.

Schedules and tables giving further details of the work done on extensions, fire services, hy-

drants and gates, during the year accompany this Report.

HYDRANTS.

NEW HYDRANTS.

Ludlow	13
Chapman	2
	<hr/>
	15

PRIVATE HYDRANTS.

Lowell Textile School	1 Ludlow
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HYDRANTS CHANGED.

SET.

Ludlow	13
Flush	1
O'Brien	1
Chapman	1
Walker	1
Corey	1
	<hr/>
	18

REMOVED.

Michigan	10
Chapman	2
Flush	5
Ludlow	1
	<hr/>
	18

REPORT OF THE BOARD OF DIRECTORS

3:

Hydrants disconnected	1
Hydrants repaired out of order and replaced	1
Hydrants repaired frozen and thawed	1
Hydrants repaired	1
Hydrants location changed	1
Wooden hydrant boxes removed	1

HYDRANTS JANUARY 1st, 1903.

KIND.		² Noz's.	³ Noz's.	⁴ Noz's.	Total. .
Boston Machine.....			172	.....	172
Chapman		3	106	49	158
Coffin.....			1	.....	1
Corey			2	.....	2
Eddy			32	1	33
Flush	439				439
Holyoke.....				1	1
Ludlow.....		3	246	1	250
Michigan.....			50	.....	50
O'Brien			1	.....	1
Perkins				1	1
Walker.....			1	.....	1
Lowrey.....	11				11
TOTAL.....	450	6	611	53	1120

PRIVATE HYDRANTS JANUARY 1, 1903.

KIND.		1 Noz.	2 Noz's.	3 Noz's.	4 Noz's.	Total.
Boston Machine.....			1	8		9
Chapman.....		1	4	1	5	11
Coffin				1		1
Flush	3					3
Kenney			1			1
Ludlow.....			18	14	10	42
Michigan.....				3		3
Perkins.....			3	1		4
Total	3	1	27	28	15	74

HYDRANTS JANUARY 1st, 1903.

KIND.	² Noz's.	³ Noz's.	⁴ Noz's.	Total.	
Boston Machine.....		172		172	
Chapman	3	106	49	158	
Coffin.....		1		1	
Corey		2		2	
Eddy		32	1	33	
Flush	439			439	
Holyoke.....			1	1	
Ludlow.....	3	246	1	250	
Michigan.....		50		50	
O'Brien		1		1	
Perkins			1	1	
Walker.....		1		1	
Lowrey.....	11			11	
TOTAL.....	450	6	611	53	1120

REPORT OF THE WATER BOARD.

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PRIVATE HYDRANTS JANUARY 1, 1908.

Kind.	No.					Total.
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
Boston Machine.....	1	8				9
Chapman.....	1	4	1	5		11
Coffin.....			1			1
Finch.....	3					3
Kenney.....		1				1
Ludlow.....		18	14	10		42
Michigan.....			3			3
Perkins.....		3	1			4
Total.....	3	1	27	28	15	74

SERVICE BOXES RENEWED AND REPAIRED.

Number of 3-4" service boxes renewed.....	11
Number of 1" service boxes renewed.....	418
Number of 2" service boxes renewed.....	2
Number of service boxes repaired.....	28

METERS RUNNING JANUARY 1ST, 1902.

Sizes.	$\frac{1}{8}$	$\frac{3}{8}$	1	1 $\frac{1}{2}$	2	3	4	6	Tot.
Columbia.....	209	5							214
Crown.....	2601	1505	297	16	19	3	5	2	4318
Desper.....	26	16	5						47
Duplex.....	4	3	5						12
Empire.....	221	30	3						254
Frost.....			1						1
Gem.....					6		2	2	10
Hersey.....	346	87	8	2					443
Lambert.....	502	67	7						576
Metropolitan.....		1							1
Nash.....	120	67	42	1					230
Niagara.....	1	1							2
Thomson.....	5	20	3						28
Trident.....	500	29	1						530
Union.....	24	8		1					33
Worthington ..	130	25	53	68	36	7	3		322
Westinghouse.....		1							1
Total	4592	1939	425	88	61	10	10	4	7129

METERS SET, REPAIRED, ETC.

New Meters set.....	545
Meters out for repairs.....	453
Meters condemned.....	41
Meters condemned replaced with new.....	41
Meters frozen and burst.....	108
Meters discontinued.....	25
Meters repaired in cellars.....	285
Number of City meters set.....	220

PRIVATE METERS RUNNING January 1st. 1903.

SIZES	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	1	2	Total
Columbia.....		9				9
Crown.....	1	25	22	2		50
Desper.....			3	1		4
Duplex.....		1				1
Empire.....		5				5
Frost.....		2	1			3
Hersey.....		8	1			9
Lambert.....		6				6
Nash.....		13	2		1	16
Thomson.....			1			1
Trident.....		6				6
Worthington.....				1	3	4
Total.....	1	75	30	4	4	114

MISCELLANEOUS.

The two Boulevard Pumping Stations and the one at Cook Wells were painted inside and out.

A new road was built on the Cushing farm from the barn along the westerly line to the Boulevard.

A new 30-inch drinking fountain was set on Rogers Street nearly opposite Concord Street. All drinking fountains were cleaned 42 times. 21 new dippers were furnished and 223 items of repairing were charged to fountains.

Thirty-one complaints of bad water were attended to and forty-four hydrants were blown out on that account.

Nineteen sewers were flushed out.

Laid two 4-inch services for electric car street sprinklers; one on Mammoth Road at Third Avenue and one at junction of Pine and Liberty Streets.

Cap and top of chimney at Centralville Pumping Station were repaired at an expense of one hundred and fifty dollars.

CONSUMPTION OF WATER.

Over one million, three hundred thousand gallons was saved in the daily consumption of water

REPORT OF THE WATER BOARD

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last year & compared with the year previous. This is a very favorable showing and shows that more is being done than ever for the improvement of last year's work in the water supply. In order to compare the work of both years in other respects, the following summary is given:

Average daily consumption in gallons.	1906	1907
Per capita consumption in gallons.	25.26	27.22
Total receipts.....	\$ 125,000.00	\$ 125,000.00
Total expenditures.....	125,000.00	125,000.00
Total charges for water.....	125,000.00	125,000.00
Main pipe in miles.....	10.00	10.00
Total number of hydrants in use.....	100	100
Total number meters in use....	1000	1000
Total number services in use....	1000	1000
Total amount of coal used in tons of 2000 lbs.....	1000	1000
Total cost of coal.....	10,000.00	10,000.00
Total expense of pumping.....	17,540.70	17,540.70
Cost of pumping per million gallons.....	8.00	8.00
Paid for interest.....	115,000.00	115,000.00
Paid for Principal (loans).....	10000	10,000.00
Paid for maintenance.....	50,000.00	50,000.00
Net indebtedness.....	1,071,120.00	1,071,120.00
Price of water per 100 cu ft.....	150 ft. 140 ft. 110 ft.	150 ft. 140 ft. 110 ft.

Received for Fire Service.....	13,000.00	none
Received for drinking fountains	500.00	none
Received for Commons and Parks.....	240.00	none
Population.....	77,000	100,000
Cases of typhoid fever.....	454	83
Deaths from typhoid fever.....	123	16

The foregoing table shows that while the population since 1890 increased 30% and the number of services or water takers 25%, the consumption is substantially as it was in 1890. The difference in the total receipts is only \$3,292.78, but if the same rates were charged that prevailed in 1890, the receipts the past year would amount to at least \$35,000.00 more. The great increase in the maintenance expense is due largely to the fact that we have to pump the well water twice and also because it is necessary to pump constantly through the twenty-four hours with three shifts, while in 1890 all the water required was pumped in eighteen hours with two crews. However, the great lesson of the foregoing figures is that the people of Lowell are getting much better quality of water for less money than they did twelve years ago, or in other words, a population 25% larger is now supplied without a corresponding increase in the amount

raised by the Department. Whether the Department can continue to furnish water without increasing the rates is a question your Honorable Board will have to meet at an early date.

Respectfully submitted,

ROBERT J. THOMAS,
Superintendent.

LOW SERVICE WATER PIPES LAID IN 1902.

STREETS.	BETWEEN WHAT STREETS.	LENGTH IN FEET.					Total.
		4-in	6-in	8-in	10-in	12-in	
Aiken ave.....	Southerly to Essex....		100				100.0
Aiken.....	Extended westerly....					29	29.0
Bertram.....	Westerly from Saunders ave.....		143				143.0
Billings	Bridge and Harker ave....		362				362.0
B & N St Ry...	Service off Foster.....	62					62.0
Boston road....	Southerly from Marshall road.....			351			351.0
Boston road....	Southerly from Cunningham.....			293			293.0
Boulevard, Paw.	Easterly from Wellington.....		158				158.0
Campaw.....	Easterly from Lakeview ave.....		153	.			153.0
Cashin	Southerly from Princeton.....		49				49.0
Chestnut	Fayette and High.....		260				260.0
Corey.....	Southerly from Princeton.....		49				49.0
Crescent.....	Northerly to Parker.....		366				366.0
Crawford.....	Easterly towards Sixth ave.....		125				125.0
Dingwell.....	Southerly from Princeton.....		484½				484.5
Dracut.....	Northerly from Third ave.....		171				171.0
Essex.....	Westerly and Northerly from Aiken av		342				342.0
Falmouth.....	Southerly from Riverside.....			495			495.0
Foster.....	Northerly from Middlesex.....			216			216.0
Fulton	Fire service to Bateman's mill.....	25					25.0
Hawthorne.....	Extended southerly.....		96				96.0
Kimball ave....	Smith and Queen.....	352					352.0
Ludlam	Easterly to Bridge street.....		205				205.0
Lundberg	Potter and Meadowcroft.....			500			500.0
Mass. M. P Co.	Fire service off Western ave.....	7	196				203.0
Meadowcroft ...	Northerly from Lundberg.....			628			628.0
Meadowcroft ...	Southerly from Lundberg.....		57				57.0
	Carried forward.....	446	3316½	2483		29	6274.5

LOW SERVICE—WATER PIPES LAID IN 1902.

STREETS	BETWEEN WHAT STREETS	LENGTH IN FEET.					Total.
		4 in.	6 in.	8 in.	10 in.	12 in.	
	Brought forward.....	446	3276½	2483		50	6274½
New York.....	Westerly from Lakeview ave.....		300				300 0
Old Meadow rd.....	Northerly from Varum ave.....		313				313 0
Old Meadow rd.....	102 in pipe ext'd to Town line 644 ft						
Orawa.....	Easterly from Lakeview ave.....		181				181 0
Parker.....	Southerly from Walden.....		140				140 0
Pawtucket.....	Easterly from Walker.....			72			72 0
Perrin.....	Fire service to Gas Co's office build'g.....	15					15 0
Pian.....	Easterly from Penn ave.....		167				167 0
Porter.....	Easterly from Huntington.....		747				747 0
Potter.....	Southerly to Lundberg.....	50					50 0
Princeton.....	Pratt St to Chelmsford line.....				1200		1200 0
Prospect.....	Extended southerly.....	30					30 0
Riverside.....	Pipe ext'n bet houses Nos 230-240.....		00				00 0
Starbird.....	Extended northerly.....		36				36 0
So Wilder.....	Northerly from Midland.....		150				150 0
Teatic School.....	Fire service off Falmouth.....	12	226	221			459 0
Thayer.....	Easterly from Bellevue.....		106				106 0
Third ave.....	Endicot and Dracut.....		273				273 0
Walden.....	Westerly to Parker.....		63				63 0
Washer.....	Easterly from Meadowcroft.....		141				141 0
Wellington.....	Fowler road and Boulevard.....		844				844 0
Wellington.....	Service to Pumping Station.....	55					55 0
Wood.....	Southerly from Princeton.....		328				328 0
	Hydrants.....		202				202 0
	Street car sprinklers.....	15	0				15 0
	Laid in 1902.....	623	7291½	2826	1200	50	11700½
	Less taken out or re-laid on Meadow- croft and Washer sts.....	141	685				826 0
	Total.....						10874½

REPORT OF THE WATER BOARD.

WASH SERVICE—WATER PIPES LAID IN 1902.

SIZES.	SIZES AND QUANTITIES.	LINES IN FEET.					Total.
		4-in.	6-in.	8-in.	10-in.	12-in.	
Between streets.	Re-laid southerly		22				22.0
Elsewhere	Re-laid from Boston		226				226.0
	Laid in 1902		228				228.0
	High Service laid previous to 1902						37425.5
	Total High Service to Jan. 1, 1903						37653.5

Brought forward.....	13,140.5 feet	
Low Service laid previous to 1902.....	645,676.0	"
	<hr/>	
Total Low Service to January 1, 1903.....	658,816.5	"
Total High Service to January 1, 1903.....	37,653.5	"
	<hr/>	
Total High and Low Service to January 1, 1903.....	696,470.0	"
Total in miles, 131.90.		

LOW SERVICE—LIST OF STOP GATES SET DURING 1902.

STREETS.	LOCATION.	4-in.	6-in.	8-in.	10 in.
Bertram	9½ feet south of north line Bertrand street, on west line Saunders avenue.....	1			
B. & N. St. Ry.....	Check valve Middlesex street, near car barn (private).....	1			
Boston road.....	12 feet east of west line Boston road at junction Boston road with Marshall road.....			1	
Campaw.....	12 feet south of north line of Campaw street, 13 feet west of east line Lakeview avenue.....	1			
Cashin ..	12 feet east of west line Cashin street, on south line Princeton street.....	1			
Chestnut	13 feet south of north line Chestnut street, 20½ feet east of west line Fayette street.....	1			
Chestnut.....	12 feet south of north line Chestnut street, 39 feet east of west line High street.....	1			
Corey	12 feet east of west line Corey street, on south line Princeton street.....	1			
Crescent	13½ feet south of north line Parker street, 12 feet west of hydrant in front of Spaulding house.....	1			
Dingwell.....	12 feet east of west line Dingwell street, on south line Princeton street.....	1			
Essex	15 feet south of curve junction Aiken avenue and Essex street, on west line Aiken Avenue.....	1			
Falmouth....	14 feet west of east line Falmouth street, on south line Riverside street.....			1	
Falmouth	15 feet west of east line Falmouth street, 3 feet north of south line passageway to Textile School.....			1	
Foster.....	12 feet west of east line Foster street, on north line Middlesex street.....			1	
Foster.....	On service to B & N St Ry power house, 25 feet east of west line Foster street.....	1			
Fulton].....	63.8 feet east of east line Mt. Vernon street, 15 feet north of south line Fulton street.....	1			
Jackson.....	On hydrant, 20½ feet north of south line of Jackson street, 134 feet west Robeson street.....			1	
Jackson.....	On Hydrant 16.2 feet north of south line Jackson street, 119.4 feet east of Robeson street.....			1	
Kimball ave.....	8½ feet north of south line Kimball avenue, 23 feet east of west line Smith street.....			1	
Kimball ave.....	9 feet north of south line Kimball avenue, on east line Queen Street.....	1			

LOW SERVICE—LIST OF STOP GATES SET DURING 1902.—Continued.

STREET.	LOCATION.	4-in	6-in	8-in	10-in
Liberty.....	On street car sprinkler stand pipe, 16 feet south of north line Liberty street, 45 feet west of east line of Penniman park.	1			
Ludlam.....	12 3 feet north of south line Ludlam street, on west line Bridge street.....	1			
Lundberg.....	12 feet north of south line Lundberg street, on east line Florence street.....	1			
Lundberg.....	12 feet north of south line Lundberg street, 3 3 feet west of west line Meadowcroft street.....	1			
Mammoth road.....	On street car sprinkler stand pipe, 19½ feet west of east line Mammoth road, 2.7 feet south of south line Third avenue.	1			
Mass. Mohair P. Co.....	In mill yard near water tower—private.....	1	2		
Mass. Mohair P. Co.....	In mill yard near water tower. Check-valve.—private.....		2		
Meadowcroft.....	10 1/2 feet west of east line Meadowcroft street, 7 feet south of north line lot on which is located house No. 108.....	1			
Merrimack Mfg. Co.....	On hydrant connection, 5.4 feet from hydrant, 7½ feet west of Dutton street.....	1			
Moody.....	On hydrant, 20 1/2 feet west of east line Moody street, on south line Textile school.....	1			
Moody.....	On hydrant, 16 feet east of west line Moody street, 7½ feet north of north line Textile school.....	1			
Mt. Hope.....	12 feet east of west line Mt. Hope street, on north line Fourth avenue.....	1			
New York.....	12 feet south of north line New York street on west line Lakewood avenue.....	1			
Old Meadow road.....	12 feet west of east line Old Meadow road, on north line Vartan avenue.....	1			
Ottawa.....	12 feet north of north line Ottawa street, 15 feet west of east line Lakewood avenue.....	1			
Perrin.....	On fire service to Gas Co's office building, 100 feet west of west line Ottawa street, 14 feet north of north line Perrin-st.....	1			
Plain.....	12 feet south of north line Plain street, opposite point of curve junction of Plain street and Brown road.....	1			
Porter.....	12 feet north of north line Porter street, on east line Huntington street.....	1			
Potter.....	12 feet east of west line Potter street, 12 feet north of north line Lundberg street.....	1			
Princeton.....	12 feet south of north line Princeton street, on west line Wood street.....	1			

LOW SERVICE—LIST OF STOP GATES SET DURING 1902.—Continued.

STREETS.	LOCATION.	4-in	6-in	8-in	10-in
Riverside.....	On 6" pipe extension between houses Nos. 239-249, 27 feet north of south line Riverside street, &c.....		1		
So. Wilder.....	13 feet west of east line So. Wilder street, on north line Midland street.....		1		
Thayer.....	12 feet south of north line Thayer street, on east line Bellevue street.....		1		
Textile School.....	On 4" pipe to boiler room, in passageway, 45 feet west of east line boiler house.....	1			
Third avenue.....	13 ft. south of north line Third avenue, on west line Endicott street.....		1		
Walden.....	12 feet north of south line Walden street, on east line Parker street.....		1		
Washer.....	12 feet north of south line of Washer street, on east line Meadowcroft street.....		1		
Wellington.....	1 foot north of south line Fowler road, 11 feet east of west line Wellington street.....		1		
Wellington.....	On south line Pawtucket Boulevard, 11 feet east of west line Wellington street.....		1		
Wellington.....	On 4" service to Pumping Station.....	1			
Wood.....	12 feet west of east line Wood street on south line Princeton street.....		1		

HIGH SERVICE—LIST OF STOP GATES SET DURING 1902.

STREETS.	LOCATION.	6-in	8-in	10-in	12-in
Eleventh.....	12 feet north of south line of Eleventh street, on east line Beacon street.....	1			
Tenth.....	16 feet south of north line Tenth street, on east line Beacon street				1

LOW SERVICE—LIST OF HYDRANTS SET DURING 1902.

STREETS.	LOCATION.
Billings.....	Northerly side, near Barker avenue.
Carpet Lane.....	Hydrant taken out, near new mill.
Dingwall.....	Westerly side, 14 feet south Princeton street.
Falmouth.....	Easterly side, 364 feet southerly from Riverside street.
Ford.....	Oesterly side, 221 feet north of Aiken street.
Jackson.....	Southerly side, in front new Appleton mill, 119 feet east of Robeson street
Jackson.....	Northerly side, between R. R. tracks, near overhead passageway.
Lakeview.....	Westerly side, 214 feet north conduit avenue.
Moody.....	Westerly side, 7½ feet north Textile School.
Moody.....	Easterly side, on south line Textile School.
New York.....	Northerly line, 313 feet west Lakeview avenue.
Pawtucket.....	Southerly side. 38¾ feet east of Merrimack street. (chnrged)
Princeton.....	Northerly side, near Chelmsford Town Line.
Pumping Station.....	Near junction Boulevard and (formerly) Wellington street.
Queen.....	Westerly side, opposite Kimball avenue.
Textile School.....	In centre of court-yard.
Wood.....	Westerly side, 287 feet south of Princeton street.

HIGH SERVICE—LIST OF HYDRANTS SET DURING 1902.

STREET.	LOCATION
Belmont avenue	Westerly side, opposite White's residence.

Report of the City Engineer.

OFFICE OF CITY ENGINEER.

LOWELL, MASS., Jan. 1, 1903.

To the Lowell Water Board:—

GENTLEMEN:—I have the honor to submit the Thirtieth Annual Report for the year ending December 31st, 1902.

PUMPAGE.

Total net pumpage for 1902.....	2,090,924,110 Gals.
Total net pumpage for 1901.....	2,576,064,071 "
A decrease in 1902 of.....	485,139,961 "

CONSUMPTION.

Consumption for 1902.....	2,091,203,586 Gals.
Consumption for 1901.....	2,576,765,224 "
A decrease in 1902 of.....	485,561,638 "

The greatest quantity pumped in one day was 9,753,000 gallons, on March 29th.

The greatest quantity pumped in one week was 47,199,375 gallons, July 14th to July 20th.

The pumpage for High Service was 52,673,894 gallons, which is 6,413,498 gallons less than that of last year.

The cost of Low Service pumpage has been Eighteen Dollars and Eighty-four Cents (\$18.84) per million gallons, an increase of Two Dollars and Fifty-eight Cents (\$2.58) per million gallons above that of last year.

The cost of High Service pumpage has been Thirty-two Dollars and Ninety-nine Cents (\$32.99) per million gallons, an increase of Five Dollars and Seventy-seven Cents (\$5.77) per million gallons above that of last year.

TABLE SHOWING QUANTITY PUMPED EACH MONTH AT THE SEVERAL STATIONS, DURING THE YEAR 1902.

MONTHS.	PUMPING STATIONS—DRIVEN WELLS.				STATION NO. 1, WEST SIXTH STREET.				Grand Totals.	Net Totals.	
	No. 2. Cook Wells	No. 4. Lo'r Boul'd.	Upper Boulevard.	Net Totals.	Worth'gton High Duty.	Worth'gton Duplex.	Murrie.	Totals Low Service			High Service
January.....		205,637.365		205,637.365	159,383.123	17,533.040		186,916.163	2,910,232	189,916.064	
February.....		194,489.885		194,489.885	140,636.875	31,618.100		171,254.975	2,058,746	174,201.075	
March.....		166,301.011	19,337.500	185,641.511	155,287.500	19,613.850		174,901.350	1,680,008	174,921.350	
April.....		147,173.410	23,901.711	170,675.121	151,209.375	10,966.110		162,175.485	2,224,040	162,118.485	
May.....		130,952.493	53,324.832	184,277.325	151,702.250		111,458.240	179,160.490	2,468,002	179,160.490	
June.....		113,864.412	66,243.010	180,108.322	184,197.125			188,197.125	372,800.481	188,197.125	
July.....		182,912.076		182,912.076	187,661.125			187,661.125	378,600.101	187,661.125	
August.....		178,632.314		178,632.314	86,363.250		16,018.860	182,382.130	469,771.024	182,382.130	
September.....		164,557.122		164,557.122	156,284.250		11,455.600	167,739.850	449,371.472	167,739.850	
October.....	19,477.904	139,438.494		158,916.398	131,336.895			131,336.895	278,537.405	152,914.379	
November.....	2,631.616	158,579.186		161,210.802	201,911.500	5,075.010	110,022.840	145,910.350	309,489.120	168,441.066	
December.....		259,387.273		259,387.273	152,837.250		90,040.160	183,777.410	415,460.484	183,777.410	
Total.....	22,109,120	2,011,923.941	162,407.531	2,183,437.160	1,599,232.500	106,796.010	362,796.480	2,068,038.990	4,317,001.808	2,068,038.990	
In 1901—2,178,818.435											
Increase in 1902 64,111.468											

*Includes 6,502.363 gallons used to flush, condact, etc.

a. Includes 6,503,863 gallons used to flush, condens. etc.

TABLE SHOWING SOURCE OF SUPPLY, QUANTITY PUMPED AND COST OF PUMPING AT THE SEVERAL STATIONS DURING THE YEAR 1902.

PUMPING STATIONS.	SOURCE OF SUPPLY—WELL WATER.				Totals in U. S. Gallons.	COST.	
	345 driven wells at Pawtucket Boulevard.	90 driven wells at City Farm.	120 driven wells in Chelmsford Mass.	Distributing mains of Low Service system.		Totals.	Per million gallons.
West Sixth Street (No. 1).....					2,068,814,990	\$18,335.41	\$ 8.86+
Low Service.....					53,673,894	745.14	14.15—
High Service.....					22,109,120	431.29	19.51—
Cook Wells (No. 2).....		22,109,120					
Hydraulic Well (No. 3) discontinued							
Lower Boulevard (No. 4).....	2,011,928,941				2,011,928,941	19,252.87	9.57—
Upper Boulevard.....	162,407,953				162,407,953	1,377.50	8.48+
Total Pumpage.....	2,005,420,073**				4,317,934,898	40,142.21	9.30—
Deduct } at Lower Boulevard.....	*6,508,868						
quantity } at Upper Boulevard.....	162,407,953**						
pumped } by High Service.....				52,673,894	2,227,010,788		
Net Pumpage.....							
Cost exclusive of High Service.....					2,090,924,110	\$40,142.21	19.20—
Total cost of High Service Pumpage.....							18.84+
							\$32.99

**Re-pumped at West Sixth Street. *Used to flush conduit, etc.

The following tables, showing the performance of the engines, depth and quality of water in the Beacon Street Reservoir, average temperature of air and water at Beacon Street Reservoir, and the average monthly and daily consumption of water, have been calculated from the records of the engineers and gate keeper.

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH DUTY ENGINE, FOR
EACH MONTH DURING THE YEAR 1902.

MONTH.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. pumped into reservoir per lb. total coal consumed.	Duty in lbs. of high grade coal used in pumping, exclusive of deduction for ashes or clinkers.	Duty on total coal consumed, no deduction for ashes or clinkers.
January.....	26	22-27	581-45	406,355	11.60	163.83	153,283.123	5,860.889	583	80,135.027	79,575.095
February.....	24	22-13	533-15	375,085	11.70	164.02	140,636.875	5,860.703	576	78,699.145	78,699.145
March.....	29	22-19	647-00	414,100	10.67	164.07	155,287.300	5,444.041	594	82,347.599	81,113.204
April.....	30	31-53	636-30	405,215	10.34	164.37	151,209.375	5,040.312	601	82,710.075	82,118.098
May.....	13	19-28	253-00	175,206	11.54	164.02	65,702.350	5,054.019	594	85,375.310	81,866.204
June.....	30	23-55	717-30	501,859	11.66	164.22	188,107.125	6,273.237	667	93,214.128	91,505.831
July.....	31	24-00	744-00	498,815	11.17	164.19	187,063.125	6,034.294	603	82,523.434	82,523.434
August.....	16	21-10	338-45	210,308	11.23	164.29	86,363.250	5,397.703	615	85,618.639	84,183.596
September.....	29	23-08	671-00	416,758	10.35	164.20	156,284.250	5,386.112	623	85,271.180	85,271.180
October.....	28	22-40	634-30	355,565	9.34	164.29	133,136.875	4,762.031	492	71,018.581	69,308.391
November.....	6	19-05	114-30	79,764	11.61	164.36	29,911.500	4,885.250	610	51,618.154	51,618.154
December.....	26	22-39	589-00	407,566	11.53	164.41	152,317.250	5,078.356	556	73,044.915	73,044.915
Totals and Averages...	288	22-31	6482-45	4,264,610	10.96	164.13	1,599,212.500	5,552.891	588	81,585.226	80,467.739

TABLE SHOWING WORK DONE WITH WORTHINGTON DUPLEX ENGINE, FOR
EACH MONTH DURING THE YEAR 1902.

MONTHS.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gals. of water pumped into reservoir per lb. of total coal consumed.	Duty in lbs. of coal used only; no deduction for ashes or clinkers.	Duty on total coal consumed, no deduction for ashes or clinkers.
January.....	10	15-52	158-45	121,074	12.71	160.95	37,532,040	3,753,204	313	24,043,233	42,043,233
February.....	8	17-17	138-15	108,510	13.08	160.39	33,638,100	4,204,762	340	45,423,854	45,423,854
March.....	7	13-43	96-00	63,335	11.00	160.78	19,633,850	2,804,836	372	49,832,724	49,832,724
April.....	4	12-07	48-30	35,181	12.09	163.05	10,906,110	2,726,527	330	44,876,031	44,876,031
May.....											
June.....											
July.....											
August.....											
September.....											
October.....											
November.....	2	10-45	21-30	16,371	12.69	163.13	5,075,010	2,537,505	248	33,717,457	33,717,457
December.....											
Totals and Averages	31	14-56	463-00	344,471	12.40	161.18	106,786,010	3,444,710	329	441,134,510	441,134,510

TABLE SHOWING WORK DONE WITH MORRIS ENGINE (BEAM AND FLY WHEEL)
FOR EACH MONTH DURING THE YEAR 1902.

MONTHS.	No. of days pumping.	Average No. of hours pumping per day.	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction, in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gallons of water pumped into reservoir per lb. total coal consumed.	Duty in lb. 1 ft. high with 100 lb. coal used in pumping only; no deduction for ashes or clinkers.	Duty on total coal consumed no deduction for ashes or clinkers.
January....											
February....											
March.....											
April.....											
May.....	23	21-14	488-30	354,557	12.10	161.78	113,458,240	4,932,967	596	80,409,185	80,409,185
June.....											
July.....											
August.....	19	21-17	404-15	300,059	12.37	160.64	96,018,880	5,053,625	516	69,115,683	69,115,683
September..	4	12-00	48-00	35,798	12.43	161.14	11,455,360	2,863,840	538	72,214,867	72,214,867
October....											
November..	26	21-54	569-30	346,637	10.14	162.14	110,923,840	4,266,302	462	64,149,265	62,439,029
December..	7	22-04	154-30	96,688	10.43	162.03	30,940,160	4,420,023	454	61,300,056	61,300,056
Totals and Averages }	79	21-04	1664-45	1,133,739	11.35	161.61	362,796,480	4,592,361	514	69,870,111	69,236,500

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH SERVICE ENGINE
FOR EACH MONTH DURING THE YEAR 1902.

MONTHS.	No. of days pump- ing.	Average No. of hours pumping per day	No. of hours pumping per month.	No. of strokes made per month.	Average No. of strokes made per minute.	Average head, including friction, in feet.	Quantity pumped per month in U. S. gallons.	Average quantity pumped per day in U. S. gallons.	No. gallons of water pumped into reservoir per lb. total coal consumed.	Coal in lbs. used when pumping.
January	12	14-40	176-00	208,518	19.75	70.44	2,919,252	243,271	300	9,718
February	8	16-30	132-00	148,819	18.79	70.44	2,083,746	260,468	300	6,943
March	8	15-07	121-00	142,007	19.56	70.44	1,988,098	248,512	300	6,626
April	8	15-04	120-30	158,860	21.97	70.44	2,224,040	285,005	300	7,412
May	8	16-07	129-00	183,493	23.71	70.44	2,568,902	321,113	300	8,561
June	18	20-32	369-30	327,431	14.77	84.59	4,584,034	254,669	300	15,256
July	31	24-00	744-00	616,000	13.80	93.59	8,624,000	278,194	300	28,747
August	31	24-00	744-00	625,470	41.01	93.59	8,756,580	282,470	300	29,185
September	30	24-00	720-00	576,910	13.35	93.59	8,076,740	269,225	300	26,875
October	24	22-37	543-00	448,888	13.87	82.99	6,284,432	261,851	300	20,942
November	8	17-00	136-00	169,162	20.73	70.44	2,368,268	296,033	300	7,892
December	9	14-47	133-00	156,843	19.65	70.44	2,195,802	243,978	300	7,318
Totals and Averages..	195	20-52	4068-00	3,762,421	15.41	84.22	52,673,894	270,123	300	175,475

TABLE SHOWING AMOUNT OF COAL USED FOR
WORTHINGTON HIGH DUTY ENGINE AT
PUMPING STATION DURING THE YEAR 1902.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pumping, in lbs.	For banking fires in lbs.	Total per month in lbs.
January.....	1,830	259,631	....	261,461
February.....	....	244,310	....	244,310
March.....	3,595	257,851	....	261,446
April.....	1,800	249,674	....	251,474
May.....	4,040	105,011	1,600	110,651
June.....	5,175	276,319	600	282,094
July.....	....	310,178	....	310,178
August.....	2,355	138,111	....	140,466
September.....	....	250,807	....	250,807
October.....	7,770	257,065	6,400	271,235
November.....	....	48,999	....	48,999
December.....	2,070	283,321	....	285,391
Totals.....	28,635	2,681,277	8,600	2,718,512

TABLE SHOWING AMOUNT OF COAL USED FOR
 WORTHINGTON DUPLEX ENGINE AT PUMP-
 ING STATION DURING THE YEAR 1902.

MONTHS.	COAL CONSUMED.			
	For starting fires in lbs.	When pumping in lbs.	For banking fires, in lbs.	Total per month in lbs.
January	119,746	....	119,746
February.....	98,987	....	98,987
March.....	52,793	....	52,793
April.....	33,024	....	33,024
May.....
June
July
August.....
September.....
October.
November.....	20,463	....	20,463
December.....
Totals.....	325,013	....	325,013

**TABLE SHOWING AMOUNT OF COAL USED FOR
MORRIS ENGINE AT PUMPING STATION
DURING THE YEAR 1902.**

MONTHS.	COAL CONSUMED.			
	For starting fires in lbs.	When pumping in. lbs.	For banking fires, in lbs.	Total per month in lbs.
January
February.....
March.....
April.....
May.....	190,243	....	190,243
June
July.....
August.....	185,989	....	185,989
September.....	21,303	....	21,303
October.....
November.....	3,800	233,656	2,600	240,056
December.....	68,157	....	68,157
Totals.....	3,800	699,348	2,600	705,748

TABLE SHOWING AMOUNT OF COAL USED FOR
DEANE ENGINES AT PUMPING STATION NO 2.
COOK WELLS. DURING THE YEAR 1902.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pumping, in lbs.	For banking fires, in lbs.	Total per month in lbs.
January.....
February.....
March.....
April.....
May.....
June.....
July.....
August.....
September.....
October.....	97,202	....	97,202
November.....	12,497	....	12,497
December.....
Totals.....	109,699	....	109,699

TABLE SHOWING AMOUNT OF COAL USED FOR
KNOWLES ENGINES AT PUMPING STATION
NO. 4, LOWER BOULEVARD, DURING
THE YEAR 1902.

MONTHS.	COAL CONSUMED.			
	For starting fires, in lbs.	When pumping, in lbs.	For banking fires, in lbs.	Total per month, in lbs.
January.....	464,044	....	464,044
February.....	452,349	....	452,349
March	354,512	....	354,512
April	294,558	....	294,558
May.....	270,276	....	270,276
June	255,727	....	255,727
July.....	435,210	....	435,210
August.....	439,973	....	439,973
September	408,744	....	408,744
October.....	356,691	5,490	362,181
November.....	430,020	....	430,020
December.....	647,886	....	647,886
Totals.....	4,809,990	5,490	4,815,480

TABLE SHOWING AMOUNT OF COAL USED FOR
WASHINGTON ENGINES AT PUMPING STA-
TION UPPER BOULEVARD DURING THE
YEAR 1900

MONTH	COAL CONSUMED			
	For starting trains, in lbs.	Water running in lbs.	For heating trains, in lbs.	Total per month, in lbs.
January.....
February.....
March.....	55,430	.....	55,430
April.....	51,885	.....	51,885
May.....	95,201	.....	95,201
June.....	131,507	.....	131,507
July.....
August.....
September.....
October.....
November.....
December.....
Totals.....	338,323	.....	338,323

**WEST SIXTH STREET PUMPING STATION, No. 1,
WORTHINGTON HIGH DUTY ENGINE,
RUNNING EXPENSES FOR THE YEAR 1902.**

Pay of Engineers and Firemen.....	\$6,168 46
529 1185-2000 tons of coal (Cumberland, 1901), at \$3.982.....	2,108 84
173 485-2000 tons of coal (Cumberland, 1902), at 3.982.....	689 85
148 329-2000 tons of coal (Cumberland, 1902), at 6.25	926 03
57 799-2000 tons of coal (Cumberland, 1902), at 4.241.....	243 43
65 675-2000 tons of coal (Cumberland, 1902), at 8.929.....	583 40
385 1039-2000 tons of coal (Cumberland, 1902), at 5.616.....	2,165 08
Gas for lighting works.....	2 50
308.25 gallons of cylindar oil, at 0.432.....	133 08
124.12 gallons of engine oil, at 0.335.....	41 52
165.06 pounds of packing, at 1.404.....	231 79
144.75 pounds of cotton waste, at 0.0775.....	11 22
29 pounds of tallow, at 0.057.....	1 65
Repairs on engine.....	136 16
Repairs on boilers.....	197 80
Tools and stock.....	45 94
Sundries.....	95 88
<hr/>	
Total.....	\$13,782 63

Cost of pumping water into reservoir per million gallons, \$8.62—

Cost of pumping water one foot high per million gallons, .05 25-100

WEST SIXTH STREET PUMPING STATION No. 1,
 WORTHINGTON DUPLEX ENGINE,
 RUNNING EXPENSES FOR THE YEAR 1902.

Pay of Engineers and Firemen.....	\$ 411 23
152 550-2000 tons of coal (Cumberland, 1901), at \$3.982.....	606 36
10 463-2000 tons of coal (Cumberland, 1902), at 5.616.....	57 46
20.55 gallons of cylinder oil, at 0.432.....	8 87
8.27 gallons of engine oil, at 0.335.....	2 77
10 pounds of packing, at 1.419.....	14 19
9.65 pounds cotton waste, at 0.0775.....	75
Repairs on boilers.....	13 19
Tools and stock.....	3 06
Sundries.....	4 95
Total	<u>\$1,122.83</u>

Cost of pumping water into reservoir per million gallons, \$10.51+

Cost of pumping water one foot high per million gallons, 0.6 52-100

**WEST SIXTH STREET PUMPING STATION, NO. 1,
MORRIS ENGINE,
RUNNING EXPENSES FOR THE YEAR 1902.**

Pay of Engineers and Firemen.....	\$1,398 18
36 650-2000 tons of coal (Cumberland, 1901), at \$3.982.....	144 65
58 1593-2000 tons of coal (Cumberland, 1902), at 3.982.....	234 13
257 1505-2000 tons of coal (Cumberland, 1902), at 5.616.....	1,447 54
Gas for lighting works.....	20
69.87 gallons of cylinder oil, at 0.432.....	30 16
28.14 gallons of engine oil, at 0.335.....	9 41
115.5 pounds of pecking, at 0.498.....	57 50
32.81 pounds of cotton waste, at 0.0775.....	2 54
33 pounds of tallow, at 0.05.....	1 65
Repairs on engine.....	31 89
Repairs on boilers.....	44 84
Tools and stock.....	10 41
Sundries.....	16 85
Total.....	\$3,429 95

Cost of pumping water into reservoir per million gallons, \$9.45+

Cost of pumping water one foot high per million gallons, .05 85-100

WEST SIXTH STREET PUMPING STATION No. 1.
HIGH SERVICE ENGINE.
RUNNING EXPENSES FOR THE YEAR 1902.

Pay of Engineers and Firemen	\$268 74
15 1800-2000 tons of coal (Cumberland, 1902) at \$5.662.....	85 46
11 625-2000 tons of coal (Cumberland, 1902) at 5.662.....	62 08
13 902-2500 tons of coal (Cumberland, 1902) at 6.25.....	82 07
6 167-2000 tons of coal (Cumberland, 1902) at 4.241.....	25 86
5 761-2000 tons of coal (Cumberland, 1902) at 5.630.....	45 04
35 1130-2000 tons of coal (Cumberland, 1902) at 5.616.....	196 73
12.33 gallons of cylinder oil at 0.432.....	5 33
4.97 gallons of engine oil at 0.335.....	1 66
8.5 pounds of packing at 1.419.....	12 06
5.79 pounds cotton waste at 0.0775.....	45
Repairs on boilers.....	7 01
Tools and stock.....	1 84
Sundries.....	2 07
Total.....	\$745 14

Cost of pumping water into reservoir per million gallons, \$14.15

Cost of pumping water one foot high per million gallons, .16 80 100

REPORT OF THE WATER BOARD.

COOK WELLS PUMPING STATION No. 2.
DEANE ENGINES.
RUNNING EXPENSES FOR THE YEAR 1902.

Pay of Engineers and Firemen	\$126 00
22 1434-2000 tons of coal (Cumberland, 1902), at \$5.982 ...	90 46
32 265-2000 tons of coal (Cumberland, 1902), at 5.616....	180 46
50 gallons of kerosene oil for lighting works, at 0.105	5 25
10 gallons of cylinder oil, at 0.45.....	4 50
10 gallons of engine oil, at 0.335.....	3 35
Repairs on engines.....	6 62
Repairs on boilers	2 50
Tools and Stock	7 35
Sundries	4 80
Total - - - - -	\$431 29

Cost of pumping water into distributing mains per million gals., \$19.51—

LOWER BOULEVARD PUMPING STATION No. 4.
KNOWLES ENGINES.
RUNNING EXPENSES FOR THE YEAR 1902.

Pay of Engineers and Firemen.....	\$ 6,331 06
567 443-2000 tons of coal (Cumberland, 1901), at \$3.983....	2,259 24
631 838-2000 tons of coal (Cumberland, 1902), at 3.982....	2,514 31
983 1914-2000 tons of coal (Cumberland, 1902), at 5.616....	5,525 90
153 100-2000 tons of coal (Cumberland, 1902), at 5.312....	813 00
69 695-2000 tons of coal (Cumberland, 1902), at 6.964....	482 94
600 gallons of kerosene oil for lighting works at 0.1025...	61 50
193.5 gallons of cylinder oil, at 0.417	80 75
27 gallons of engine oil, at 0.35.....	9 45
107.12+ pounds of packing, at 1.182—.....	126 60
193 pounds of cotton waste, at 0.0737+.....	14 23
Repairs on engines.....	341 70
Repairs on boilers.....	509 40
Tools and stock....	85 44
Sundries	97 35
Total - - - - -	\$19,252 87

Cost of pumping water into conduit per million gallons, \$9.57—

UPPER BOULEVARD PUMPING STATION.
 WORTHINGTON ENGINES.
 RUNNING EXPENSES FOR THE YEAR 1902.

Pay of Engineers and Fremen	\$ 430 25
33 1445-2000 tons of coal [Cumberland, 1902], at \$3.982....	134 28
135 878-2000 tons of coal [Cumberland, 1902], at 5.616,...	760 63
16 gallons of cylinder oil, at 0.417	6 67
3 gallons engine oil, at 0.35.....	1 05
50.25 pounds of packing, at 0.592.....	29 73
16 pounds of cotton waste, at 0.0775.....	1 24
24 pounds of tallow, at 0.05	1 20
Tools and stock.....	11 18
Sundries.....	1 27
Total - - - - -	\$1,377 50

Cost of pumping water into conduit per million gallons, \$8.48+

RESERVIOR, BEACON STREET, 1902.

MONTHS.	Depth in Feet.	Quantity in U. S. Gallons.	Temperature in Degrees.	
			Of Water.	Of Air
January	19 23	29,216,172	43 95	25 10
February.....	18 88	28,631,261	40 23	27 49
March.....	18 27	27,627,404	37 79	42 31
April.....	19 45	29,594,002	38 07	47 52
May.....	17 95	27,004,563	40 48	59 09
June	19 39	29,482,792	45 58	65 94
July.....	19 78	30,140,340	52 56	69 04
August.....	19 69	29,997,115	57 32	68 01
September	19 86	30,285,120	59 32	62 34
October	19 65	29,926,954	58 71	52 51
November.....	10 61	29,849,827	56 70	44 38
December	19 59	28,144,321	51 44	27 29

TABLE SHOWING THE AVERAGE MONTHLY AND
DAILY CONSUMPTION OF WATER FOR THE
YEAY 1902.

MONTHS.	Gallons per Month.	Gallons per Day.
January	191,307.825	6,171,220
February.....	171,214,521	6,114,804
March.....	175,204,211	5,651,749
April	163,381,369	5,446,046
May.....	179,719,442	5,797,401
June	186,513,503	6,217,117
July.....	188,607,215	6,083,104
August.....	184,872,170	5,963,910
September.....	163,846,557	5,461,552
October	158,342,364	5,107,818
November.....	143,154,916	4,771,831
December	185,039,488	5,969,016
Totals and Averages.....	2,091,103,586	5,729,325

SUMMARY OF STATISTICS.

FOR THE YEAR ENDING DECEMBER 31ST, 1902.

In form recommended by the New England Water Works Association.

LOWELL WATER WORKS

LOWELL, MIDDLESEX COUNTY, MASSACHUSETTS.

GENERAL STATISTICS.

Population by census of 1900, 94,969.

Date of construction, 1870 to 1873.

Date of construction, High Service, 1881.

Date of construction, Driven Wells, 1893 to 1903.

By whom owned : The City of Lowell.

Source of supply : Two hundred and ten (210) driven wells
in the valley of River Meadow Brook, and three hun-
dred forty-five (345) driven wells at Pawtucket Boule-
vard.

Mode of supply : Pumping to reservoir and pumping direct.

PUMPING STATISTICS.

1. Builders of Pumping Machinery.

AT WEST SIXTH STREET STATION. No. 1.

One engine, capacity 5,000,000 gallons in 24 hours, Henry G. Morris.

One engine, capacity 5,000,000 gallons in 24 hours, Henry R. Worth-
ington.

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL
WATER ANALYSIS.—Merrimack River. (Parts in 100,000.)

NO.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.				AMONIA.			Nitrogen as		Iron.	Oxygen Consumed.
	Collec- tion.	Exam- nation.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss in light.	Fixed.	Free.	Total.	In solu- tion.	In sus- pen- sion.	Nitrates.	Nitrites.		
38,752	Jan. 22	23	slight	slight	.29	faintly unpleasant	distinctly unpleasant	4.05	2.00	2.05	.0636	.0148	.0124	.0024	.0020	.0001	.08	.54
39,155	Feb. 25	26	slight	slight	.24	faintly unpleasant	distinctly unpleasant	3.50	1.50	2.00	.00.60	.0130	.0104	.0026	.0090	.0000	.08	.42
39,453	Mar. 27	28	slight	slight	.27	faintly vegetable	distinctly vegetable	2.60	1.30	1.30	.0006	.0128	.0100	.0028	.0051	.0000	.06	.44
39,862	April 30	May 1	decided	cons.	.36	faintly unpleasant	faintly unpleasant	2.80	1.00	1.80	.0010	.0168	.0140	.0028	.0090	.0001	.08	.65
40,257	May 27	29	none	slight	.29	none	faintly vegetable	3.10	1.30	1.80	.0040	.0150	.0118	.0032	.0050	.0001	.06	.60
40,776	June 24	25	v slight	cons.	.32	faintly vegetable	distinctly vegetable	3.35	1.25	2.10	.0040	.0178	.0156	.0022	.0050	.0001	.06	.68
41,333	July 24	25	v slight	slight	.31	none	faintly vegetable	3.40	1.50	1.90	.0034	.0166	.0156	.0010	.0080	.0002	.08	.54
41,915	Aug. 27	28	decided	cons.	.38	faintly unpleasant	faintly unpleasant	3.40	1.35	2.05	.0066	.0180	.0142	.0038	.0050	.0002	.11	.68
42,448	Sept. 25	26	slight	cons.	.32	faintly vegetable	distinctly vegetable	5.00	2.00	2.70	.0078	.0164	.0130	.0034	.0080	.0002	..	.55
43,009	Nov. 3	4	slight	slight	.55	faintly unpleasant	distinctly unpleasant	3.00	1.05	2.25	.0018	.0144	.0138	.0026	.0010	.0000	.08	.80
43,299	Nov. 25	26	v slight	slight	.41	faintly vegetable	distinctly vegetable	3.80	1.50	2.30	.0080	.0146	.0132	.0014	.0050	.0001	.11	.57
43,610	Dec. 30	1	slight	slight	.35	v faintly vegetable	faintly vegetable	3.50	1.50	2.00	.0020	.0150	.0134	.0016	.0050	.0001	.11	.60

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL
WATER ANALYSIS.—Boulevard Wells. (Parts in 100,000.)

NO.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON			AMMONIA.			Chlorine	Nitrogen as		Hardness	Iron	Oxygen Consumed
	Examination.	Collection	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on Ignition.	Fixed.	Free.	Total.	In solution.		Nitrates.	Nitrites.			
38,753	Jan. 1902. 23	23	slight	slight	.07	none	none	5.00	....	....	.0036	.0018	....	.24	.0190	.0000	1.6	.0500	.08
39,156	Feb. 25	26	none	v slight	.08	none	none	3.50	....	....	.0036	.0022	....	.23	.0250	.0000	1.3	.0160	.07
39,454	Mar. 27	28	v slight	v slight	.07	none	none	3.90	....	....	.0064	.0028	....	.21	.0210	.0000	1.3	.0550	.08
39,863	April May 30	1	none	none	.00	none	none	3.60	....	....	.0000	.0020	....	.22	.0400	.0000	1.8	.0030	.03
40,258	May. 27	29	v slight	v slight	.08	none	none	3.00	....	....	.0038	.0028	....	.20	.0210	.0001	1.3	.0250	.08
40,777	June 24	25	none	none	.00	none	none	3.80	....	....	.0010	.0038	....	.18	.0220	.0001	1.3	.0050	.06
41,334	July 24	25	v slight	v slight	.03	none	none	4.80	....	....	.0042	.0040	....	.16	.0100	.0003	1.3	.0800	.09
41,916	Aug. 27	28	none	v slight	.10	none	none	4.10	....	....	.0056	.0064	....	.21	.0060	.0000	1.4	.0480	.10
42,449	Sept. 25	26	none	none	.08	none	none	4.50	....	....	.0042	.0040	....	.22	.0060	.0000	1.3	.0210	.11
43,010	Nov. 3	5	v slight	v slight	.10	none	none	4.00	....	....	.0054	.0048	....	.22	.0030	.0000	1.4	.0380	.10
43,300	Nov. 25	26	v slight	slight	.09	none	none	4.50	....	....	.0048	.0036	....	.19	.0080	.0000	1.8	.0600	.10
43,632	Dec. Jan. 30	1	v slight	slight iron	turbid .20	none	none	4.00	....	....	.0090	.0036	....	.25	.0250	.0000	1.7	.0400	.09

**COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL
WATER ANALYSIS.—Pumping Station. (Parts in 100,000.)**

NO.	DATE OF		APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.			AMMONIA.				Nitrogen as		Hardness.	Iron	Oxygen Consumed	
	Collection	Examina- tion.	Turbidity.	Sediment	Color.	Cold.	Hot.	Total.	Loss on Ignition	Fixed	Free	Total.	In solu- tion.	In sus- pen- sion.	Chlorine.	Nitrates.				
38,754	Jan. 1902. 23		none	none	.02	none	none	4.70	....	....	.0026	.0020	....	....	.27	.0180	.0000	1.7	.0150	.06
39,455	Mar. 27 28		v slight	none	.07	none	none	4.00	....	....	.0048	.0012	....	....	.33	.0160	.0000	1.6	.0160	.08
39,804	Apr. May 30 1		slight	cons. iron	.09	none	none	4.60	....	....	.0000	.0054	....	....	.23	.0030	.0000	1.8	.0800	.10
40,259	May 27 29		none	v slight	.05	none	none	4.10	....	....	.0050	.0018	....	....	.23	.0110	.0000	1.8	.0060	.08
40,778	June 24 25		none	v slight	.00	none	none	4.30	....	....	.0006	.0012	....	....	.22	.0180	.0000	1.4	.0060	.07
41,335	July 24 25		v slight	none	.01	none	none	5.00	....	....	.0014	.0014	....	....	.18	.0140	.0001	1.4	.0000	.13
41,917	Aug. 27 28		v slight	none	.02	none	none	3.60	....	....	.0014	.0010	....	....	.24	.0110	.0000	1.4	.0150	.09
42,450	Sept. 25 25		v slight	none	.03	none	none	4.00	....	....	.0014	.0016	....	....	.25	.0120	.0000	1.7	.0000	.09
	Nov. 3 5		v slight	v slight	.06	none	none	4.50	....	....	.0025	.0016	....	....	.24	.0110	.0000	1.4	.0140	.09
	Nov. 23 26		v slight	slight	.05	none	distinctly unpleasant S. Or	4.60	....	....	.0014	.0010	....	....	.27	.0140	.0000	1.8	.0160	.09
	Dec. Jan. 30 1		slight	cons. iron	.01	none	none	4.20	....	....	.0016	.0041	....	....	.26	.0100	.0000	1.8	.0160	.07

31046

CITY OF LOWELL.

IN BOARD OF ALDERMEN,
March 22, 1904.

Received and ordered on file. Sent down for
concurrence.

GIRARD P. DADMAN,
City Clerk.

IN COMMON COUNCIL,
April 12, 1904.

Received and ordered on file, in concurrence.

FRANK M. DOWLING,
Clerk.

JUN 27 1904

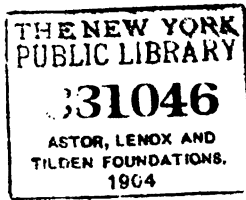
THIRTY-FIRST
ANNUAL REPORT
OF THE
★
LOWELL WATER BOARD

TO THE
City Council of the City of Lowell, Mass.

AND THE
Reports of the Superintendent of Water Works and of
the City Engineer to the Water Board for 1903.



LOWELL, MASS.
COURIER-CITIZEN COMPANY.
1904.



CITY OF LOWELL.

IN BOARD OF ALDERMEN.

March 22, 1904.

Received and ordered on file. Sent down for concurrence.

GIRARD P. DADMAN,

City Clerk.

IN COMMON COUNCIL,

April 12, 1904.

Received and ordered on file, in concurrence.

FRANK M. DOWLING,

Clerk.

WATER DEPARTMENT, 1903.

WATER BOARD.

FRANK L. WEAVER, President.

Term expires second Monday in March, 1904.

MICHAEL J. DOWD.

Term expires second Monday in March, 1905.

AUGUST FELS.

Term expires second Monday in March, 1906.

ROBERT J. CROWLEY.

Term expires second Monday in March, 1907.

JOHN W. CRAWFORD, Secretary and Clerk.

ROBERT J. THOMAS, Superintendent.

GEORGE BOWERS, City Engineer.

D. B. H. BARTLETT, Engineer.

THOMAS McLOUGHLIN, Engineer.

JOHN B. HENRY, Keeper Reservoir.

THOMAS F. DOYLE, Foreman.

WILLIAM JOYCE, Assistant Foreman.

JOHN E. LOWNY, Meter Inspector.

ALBERT HALLOWELL, Foreman Shop.

A. F. COGER, Hydrants and Gates.

EDWARD WALSH, Services.

OFFICE.

GEORGE E. WORTHEN, Service Clerk.

GERTRUDE W. BYAM, Bookkeeper.

JULIA J. RAFTER, Assistant Bookkeeper.

INSPECTORS.

ROBERT GARDNER.

FREDERICK A. BARON.

MICHAEL H. McCUE.

GEORGE F. TILTON.

WALTER P. WILEY.

Report of the Water Board.

OFFICE OF THE WATER BOARD,
CITY HALL,

LOWELL, MASS., January 1, 1904.

*To His Honor the Mayor and the City Council of the
City of Lowell:*

The Water Board herewith submits its annual report for the year ending December 31st, 1903. The year has been marked by the practice of the strictest economy in the Department, made necessary by the large bills paid for fuel at the beginning of the year. Although the high standard and efficiency of the Works was not permitted to be lowered, much work was deferred until such time as the financial conditions are better.

The total outgo was \$200,232.47 against total receipts of \$196,127.20 and our balance was reduced to \$3,059.92. The amount paid for maintenance and construction, exclusive of interest and payment on notes was \$125,305.84 as against \$122,512.86 last

year; but there was paid \$43,824.68 for coal in 1903 as against \$18,516.60 in 1902, a margin of over \$25,000. The last payment on the second Driven Well loan of 1894 will be paid in 1904, thus saving to the Department \$5,000.00 annually. The extinguishing of these loans will be a great relief, for owing to the decreased income from water rates, owing to increased use of meters makes it necessary there should be less expenditure. The amount paid on loans was \$21,600.00 and for interest \$48,190.00; the total debt for Water Works is \$1,183,900.00; Bonds—Water loan, \$1,000,000.00, High Service, \$75,000.00, Notes, \$108,900.00. The sinking fund for the bonds amounts to \$317,335.14 for the Water Works loan and \$56,170.60, for the High Service.

The Water Board met to organize, as provided, on the second Monday in March, when Mr. Robert J. Crowley, elected by the City Council to succeed Mr. H. C. Taft, took his seat as a member of the Water Board. Mr. Weaver was re-elected President and Mr. Thomas, Superintendent. The usual ten per cent. discount on bills for water was recommended, but with the additional proviso that the bills must be paid within thirty days to secure the discount and this had a very good effect in getting bills paid promptly.

On Saturday, July 18th, there occurred a fire on the Merrimack Corporation, at which the Locks & Canals' reservoir was drawn upon to such an extent that the pressure in their pipes went below the City pressure, consequently the check valves between the two systems opened and the City water flowed into the Locks & Canals pipes until the fire was extin-

guished. When the Locks & Canals Co. started pumping, it was found that their reservoir did not fill, and on investigation it was found that a check valve situated on the Massachusetts Corp. near the corner of Canal and Bridge Streets had failed to close and water from the Locks and Canals was flowing into the City mains; the gates at that point were immediately shut. Within a few days an epidemic of sickness appeared resembling "Summer Complaint," so called, or cholera morbus and later developed numerous cases of typhoid fever, so that on July 28th the Board was called together to consider the charge, "That the prevailing epidemic of sickness is caused by the City water." The State Board of Health was notified to take samples of the water for examination, and it was voted to have the water blown from the mains. On July 31st it was voted to notify the Locks & Canals Co., and the individual members thereof, that at the next meeting of the Water Board the subject of discontinuing the connections between the Locks & Canals and the City system of pipes would be taken up for consideration, and on August 4th a meeting was held at which the Corporations were represented and the subject was discussed at considerable length, and various plans were suggested for supplying the Locks & Canals with water from the City supply but nothing definite was adopted. At a meeting August 18th, it was voted to advise the Locks & Canals that all the gates between the Locks & Canals and City systems would be closed on Saturday, August 22nd, at 9 A. M. August 20th there was another meeting with the representatives of the Corporations, when it was

arranged that the City should prepare and present to the Locks & Canals a plan for the most expeditious way to bring about a settlement and put it into practice. Mr. Bowers and Mr. Thomas were appointed a Committee to prepare a plan.

October 3rd a communication was received from the Locks & Canals, as follows:

OFFICE OF THE PROPRIETORS OF THE LOCKS AND CANALS ON
MERRIMACK RIVER.

LOWELL, MASS., September 30th, 1903.

MR. GEORGE BOWERS, City Engineer,
MR. ROBERT J. THOMAS, Superintendent of Water Works.

GENTLEMEN:—By letter of August 25, I was informed that the Lowell Water Board had voted to refer the matter of adjustment of the City Water and Corporation system of extinguishing fires to the City Engineer and the Superintendent of Water Works. At the following conference on August 27th, you took the ground that the City's supply of driven well water was so small that you wished to reserve it for drinking and would prefer not to have it used merely for putting out fires; that the supply of river water to the Locks & Canals was unlimited and suited to putting out fires, and that you would much prefer the two systems should be entirely distinct.

You expressed willingness that the City should put as many hydrants along the streets bordering the mill property as on the streets adjacent to other valuable property and might agree to putting some hydrants within the mill yards to be sealed and opened only for fires, but in the latter case you would expect pay for the pipes entering the mill yards.

At a former conference with the Lowell Water Board the Chairman of the Board had proposed that the Locks & Canals should cut off all connection of their system with river water

and connect steam pumps to the City mains at several points, and force City water at greater pressure into the Locks & Canals system of pipes and reservoir.

Upon consideration of this proposition it was found that the City mains are not large enough to supply such quantity of water as may be needed to protect the mill property in addition to the general demands of the City service.

The alternative is to produce in the mill yards an adequate supply for the higher pressure of the Locks & Canals system independent of the City mains, and depend upon these mains for supplementing this supply from hydrants connected with the City mains and placed as conveniently accessible to the mill property as practicable.

To accomplish this, additional steam pumps will be set up as soon as practicable in the mill yards and the Locks & Canals will ask from the City permission to lay a new twenty-four-inch main from their reservoir on Lynde's Hill to the mills either in the place of the twelve-inch main now in Fairmount, Nesmith and East Merrimack Streets or by some other route soon to be determined.

We have now to ask the Lowell Water Board, through you, to have set up additional hydrants, shown upon the accompanying plans, generally near the City mains and near the entrances to the mill yards where steamers may be placed to force water upon adjacent buildings or into mill yards.

One fourway post hydrant located at each of the following places:

MERRIMACK MANUFACTURING CO.

Alleyway foot of Kirk Street.
Worthen Street, near Old Packing Building.

MIDDLESEX CO.

Warren Street, opposite Counting Room.
Hurd Street, opposite Watch House.

There were 168 cases of Typhoid Fever reported and 9 deaths from August 1 to September 26 in 1903, as against 15 cases and 6 deaths in 1902, and 13 cases and 1 death in 1901.

The following rules governing Fire Services were adopted:

No Fire Service pipe shall be laid into the premises of any Corporation, Firm or Individual having connected therewith, directly or indirectly, supplementary or secondary Fire Service consisting of fire pump, cistern, tank, standpipe or other apparatus, excepting where such fire pumps, cistern, tank, standpipe, etc., is supplied with water from the City Water Works system and subject to the following regulations:

First. All water for Fire Service pipes shall be metered; meter to be furnished and set by City at owner's expense. No charge shall be made, however, for water used exclusively for the extinguishing of fires.

Second. All main pipes for Fire Services shall be furnished and connected by the City at the expense of the owner.

Third. Where a standpipe, tank or cistern is used it shall be constructed in such a manner as to shield and protect the water from all possible pollution.

Fourth. Provision shall be made in its construction for means of access to the interior of it by the Superintendent or other Agents of the Water Department for the purpose of inspection, and so as to allow for its cleaning as required by the Water Department.

Fifth. It shall also be fitted with a pipe for the purpose of drawing off all the water at such intervals as required by the Water Department.

REPORT OF THE WATER BOARD.

BIGELOW CARPET CO.

Market Street, near Merrimack Canal.
Market Street, near Shattuck Street.

BOOTT COTTON MILLS.

Amory Street, foot of John Street (left).
Amory Street, foot of John Street (right).

MASSACHUSETTS COTTON MILLS.

Canal Street, near Massachusetts Counting Room bridge.
East Merrimack Street, near Eastern Canal.
East Merrimack Street, opposite Prescott Spinning Mill.

LOWELL MACHINE SHOP.

Dutton Street, opposite Counting Room.
Jackson Street, near Foundry entrance.

It is important that these additional hydrants be erected as soon as practicable, in order to be of service in a fire this winter, before the Locks & Canals system can be completed.

Respectfully yours,

(Signed) HIRAM F. MILLS,

Engineer P. L. & C.

Mr. Mills also stated that, "They had been over the matter of hydrant service for the different Corporations very carefully and find some already well protected and believe with the thirteen hydrants described that no more will be needed."

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Fourth. Provision shall be made in its construction for means of access to the interior of it by the Superintendent or other Agents of the Water Department for the purpose of inspection, and so as to allow for its cleaning as required by the Water Department.

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Fourth. Provision shall be made in its construction for means of access to the interior of it by the Superintendent or other Agents of the Water Department for the purpose of inspection, and so as to allow for its cleaning as required by the Water Department.

Fifth. It shall also be fitted with a pipe for the purpose of drawing off all the water at such intervals as required by the Water Department.

Sixth. Said draw-off pipe must not be connected with a sewer or drain in a way that might lead to the contamination of the water from such source.

Seventh. All expenses not mentioned herein, incurred on account of Fire Services, shall be borne by the Corporation, firm or individual owning the protected premises.

Eighth. The Water Board shall have the power from time to time to prescribe whatever other rules they may deem necessary.

It was also voted, "That the Superintendent shall notify all persons, individuals and corporations having private Fire Services connected with the City system with check valves, that the Water Board look with disfavor on all check valves, and that all fire pumps must be discontinued to prevent any possible contamination of the City water by other water entering the City pipes."

We expect this to prevent the possibility of a recurrence of this kind of accident.

FRANK L. WEAVER,
AUGUST FELS,
MICHAEL J. DOWD,
ROBERT J. CROWLEY.

LOWELL WATER WORKS OFFICE,
January 1, 1904.

TO THE LOWELL WATER BOARD :

Gentlemen:—Herewith I submit figures detailing the finances of the Lowell Water Works for the year ending December 31st, 1903.

J. W. CRAWFORD, *Clerk*.

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1903.

TABLE I	CHARGES.					RECEIPTS BY ACCOUNTS.				
	WATER			Other than Water	Total Charges 1903	Total Charges 1902	Receipts	Discounts	Abatement	Due
	Rate	Metered	Total							
Transfer from '02										
February	\$ 10 00	\$ 20 02	\$ 30 02	\$1,987 43	\$40,714 36	.....	\$35,050 06	\$3,443 41	\$331 75	\$ 1,968 34
March	39,208 51	37,709 57	76,918 08	.....	2,017 45	.....	1,817 91	2 00	2 30	195 34
April				.....	76,918 08	.....	70,366 37	5,508 32	967 31	66 18
May				.....	2,559 17	.....	2,180 89	.....	.....	378 28
June	3,295 87	54,137 85	57,433 72	.....	1,942 91	.....	1,603 20	.....	.....	339 71
July				.....	58,533 37	.....	52,513 19	4,906 30	920 73	193 15
August				.....	1,210 21	.....	1,116 37	.....	65	93 19
September	945 57	32,336 99	33,282 56	.....	1,171 79	.....	860 36	.....	2 40	309 00
October				.....	1,141 18	.....	27,867 56	2,880 30	225 49	3,450 39
November				.....	1,341 96	.....	949 40	.....	16 45	376 11
December	675 60	30,369 43	31,045 03	.....	1,340 69	.....	724 16	.....	.....	616 53
				.....	939 39	.....	1,076 90	26 69	8 00	30,572 93
Totals	\$44,135 55	\$154,573 86	\$198,709 41	\$14,734 38	\$254,158 15	.....	\$196,127 29	\$16,766 92	\$2,395 08	\$38,868 95

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1903.—OUTGO.

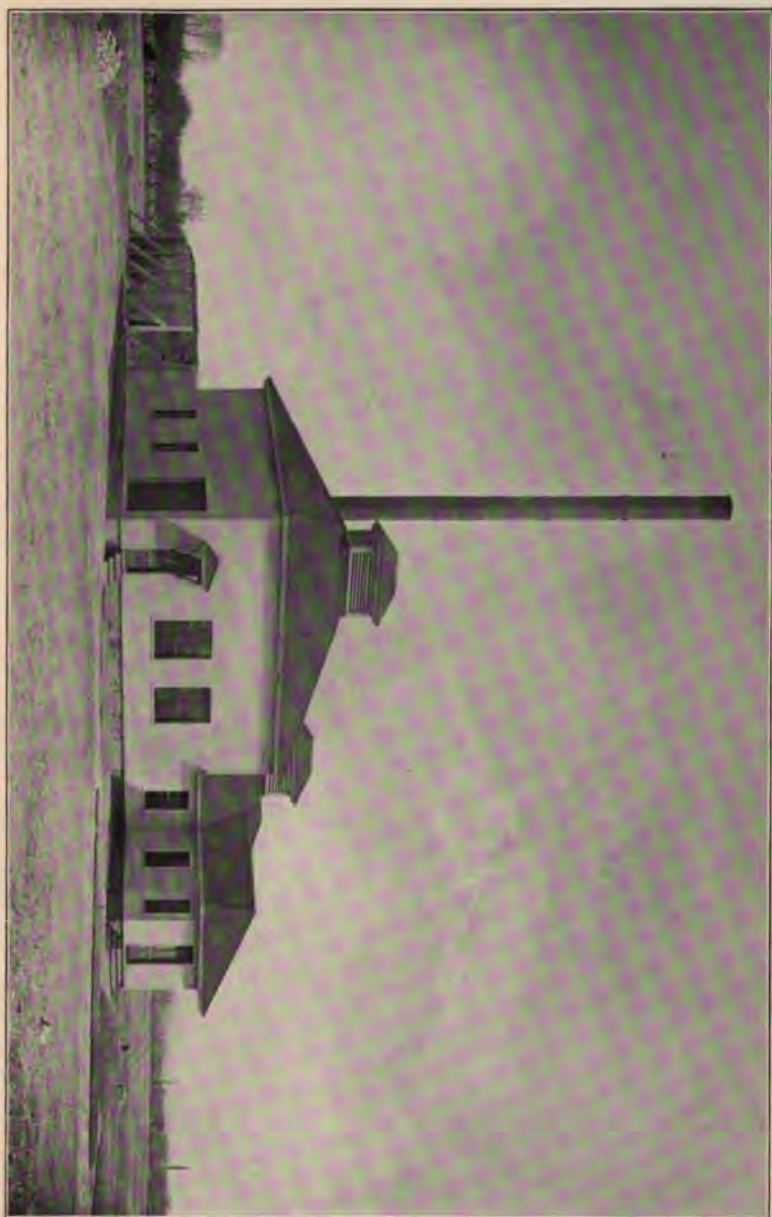
TABLE
II

	Pay Roll and Salaries	Water Works Supplies	Interest and Principal	Refund and Vacancies	General Expense	Stable	Fuel	Total 1903
January	\$5,803 83	\$ 622 21	\$ 320 00	\$ 53 38	\$129 44	\$155 27	\$13,747 50	\$20,831 03
February	4,989 08	963 14	2,175 00	592 41	33 74	21 88	1,003 50	8,838 81
March	4,730 31	889 56	700 00	30 08	115 09	48 15	6,757 57	13,270 70
April	5,043 72	1,190 07	100 00	470 22	333 17	161 17	54 73	7,353 08
May	6,908 96	1,422 03	18,130 00	317 20	165 08	298 79	1,115 59	28,337 05
June	5,843 77	984 72	3,500 00	28 20	548 13	24 56	5,139 58	16,008 90
July	5,957 17	845 14	17,520 00	91 25	27 04	43 46	7,404 00	31,808 72
August	6,978 92	633 47	2,275 00	66 08	103 41	52 56	1,035 03	11,744 47
September	5,477 28	681 02	.....	9 17	257 75	17 08	3,081 07	10,123 37
October	6,544 97	1,206 41	4,300 00	152 31	76 20	198 88	1,412 40	13,891 17
November	5,563 27	1,461 87	20,770 00	46 77	251 92	115 27	1,812 99	30,022 09
December	5 534 93	985 68	.....	33 50	262 85	24 80	.....	6,841 76
Totals	\$69,376 21	\$11,885 32	\$69,790 00	\$1,800 57	\$2,303 82	\$1,161 87	\$43,824 68	\$200,232 47

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1903.
SUBDIVISION OF "OTHER THAN WATER CHARGES" FROM TABLE I.

TABLE
III

	Meters Sold	Expense Setting Meters	Repairs of Meters	New Services	Changed Services	Labor and Material	Shut off Fees	Interest	Total 1903
February	\$ 685 50	\$101 97	\$379 33	\$151 85	\$17 88	\$648 90	\$2 00	.....	\$1,987 43
April	1,635 00	287 36	96 79	116 04	.....	423 98	.....	.....	2,550 17
May	1,221 25	201 27	63 19	171 94	62 46	222 80	.....	.....	1,942 91
June	470 50	72 95	78 50	224 81	7 35	245 54	10 00	.....	1,099 65
July	422 00	61 23	48 73	205 21	.....	463 04	6 00	.....	1,210 21
August	537 50	76 42	60 30	112 56	37 62	341 39	.....	.....	1,171 79
September	262 75	49 30	76 42	130 11	25 80	596 80	.....	.....	1,141 18
October	497 75	59 66	25 27	194 06	3 80	280 32	14 00	207 10	1,341 96
November	416 50	45 50	28 79	168 46	2 45	672 90	6 00	.....	1,340 09
December	161 50	17 01	86 12	78 70	.....	504 06	2 00	.....	930 39
Totals	\$6,310 25	\$972 76	\$943 44	\$1,553 74	\$157 30	\$4,489 73	\$40 00	\$267 10	\$14,734 38



UPPER PUMPING STATION, BOULEVARD.

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1903.

SUBDIVISION OF "PAY ROLL AND SALARIES" FROM TABLE II.

TABLE IV	Salaries	Meter Work	Office and Inspectors	Extension and Construct.	Engineering	No. 1 Central-ville	No. 2 Cook Plant	No. 4 Lower Boulevard	No. 5 Upper Boulevard	Services	Re-charged	Maintenance	Total 1903
Jan.	\$283 32	\$423 00	\$757 94	\$ 84 91	.....	\$729 40	\$ 77 75	\$626 15	.....	\$ 32 82	.....	\$2,788 54	\$5,803 83
Feb.	283 36	255 00	683 04	76 70	\$329 37	670 72	63 00	.....	\$533 29	26 25	.....	2,068 35	4,989 08
March ..	283 32	366 25	683 04	93 45	100 00	681 72	63 00	503 04	.....	135 00	.....	1,821 49	4,730 31
April	283 32	389 25	683 04	148 08	125 00	648 22	63 00	532 04	.....	128 00	.....	2,043 77	5,043 72
May	283 36	412 63	853 80	765 26	100 00	858 84	78 75	662-55	.....	272 86	.....	2,620 91	6,908 96
June	283 32	300 82	683 04	500 27	100 00	636 47	63 00	599 04	.....	152 15	.....	2,525 66	5,843 77
July	283 32	227 24	683 04	582 56	125 00	658 72	63 00	512 58	.....	101 36	.....	2,660 35	5,957 17
August ..	283 36	241 79	853 80	381 99	100 00	664 65	78 75	632 43	.....	183 79	.....	3,558 36	6,978 92
Sept.	283 32	177 36	683 04	192 81	100 00	620 72	63 00	505 04	.....	127 21	\$93 90	2,630 89	5,477 28
October ..	283 32	274 15	853 80	161 50	125 00	754 28	244 89	709 43	.....	205 04	14 25	2,919 31	6,544 97
Nov.	283 36	202 63	683 04	275 48	100 00	679 47	220 57	463 29	.....	169 45	.....	2,485 98	5,563 27
Dec.	283 32	264 13	803 55	459 04	.....	794 11	74 25	595 42	.....	50 63	.....	2,210 48	5,534 93
Totals ..	\$3,400 00	\$3,534 25	\$8,904 17	\$3,722 05	\$1,304 37	\$8,397 32	\$1,152 96	\$6,341 01	\$533 29	\$1,644 55	\$108 15	\$30,334 08	\$69,376 21

TABLE V.

FINANCIAL STATEMENT — LOWELL WATER WORKS,
1903.

SUBDIVISION "WATER WORKS SUPPLIES," FROM TABLE II.

Pumping Station Supplies (Centralville Sta.)	\$ 838 48
Pumping Station Supplies (Cook plant Sta.)	86 59
Pumping Station Supplies (Boulevard, Lower Sta.)	884 09
Cast iron pipe and specials	765 73
Hydrants and gates and gate boxes	581 32
Service pipe and service boxes	2,356 76
Meters	2,556 26
Machinery and tools	285 75
Brass foundry	42 45
Miscellaneous	3,487 89
	<hr/>
	\$11,885 32

TABLE VI.
FINANCIAL STATEMENT—LOWELL WATER WORKS,
1903.

DETAIL OF "PRINCIPLE AND INTEREST" FROM TABLE II.

	Amount of Debt Jan. 1, 1903.	Rate.	Interest Paid 1903.	Paid on Notes 1903.	Amount of Debt Jan. 1, 1904.
Water loan bonds ..	\$1,000,000 00 4		.....	.....	\$1,000,000 00
5 Coupons, No. 23, May 1, 1902 .....	.....		\$ 100 00	.....	.....
58 Coupons, No. 24, Nov. 1, 1902 .....	.....		1,160 00	.....	.....
995 Coupons, No. 25, May 1, 1903 .....	.....		19,900 00	.....	.....
943 Coupons, No. 26, Nov. 1, 1903 .....	.....		18,860 00	.....	.....
High Service bonds ..	75,000 00 4		.....	.....	75,000 00
15 Coupons, No. 43, May 1, 1903 .....	.....		1,500 00	.....	.....
15 Coupons, No. 44, Nov. 1, 1903 .....	.....		1,500 00	.....	.....
NOTES.					
Lowell Inst. Savings,	10,000 00 3½		350 00	5,000 00	5,000 00
Lowell Inst. Savings,	20,500 00 4		820 00	4,100 00	16,400 00
Sundry persons	40,000 00 4		1,600 00	5,000 00	35,000 00
Estabrook & Co ..	60,000 00 4		2,400 00	7,500 00	52,500 00
	\$1,205,500 00		\$48,190 00	\$21,500 00	\$1,183,900 00

TABLE VII.

FINANCIAL STATEMENT — LOWELL WATER WORKS,
1903.

MAINTENANCE AND CONSTRUCTION ACCOUNT.

MAINTENANCE.

Paid for labor:

Salary of Superintendent	\$ 1,800 00
Salary of Water Board	1,600 00
Office and Inspectors	8,904 17
Pumping stations	16,424 58
Meter work	3,534 25
Engineering	1,304 37
General maintenance	30,467 87

Paid for material:

Output as per stock book	971 29
General expense	2,303 52
Stable	1,101 87
Machinery and tools	285 75
Pumping station supplies	1,809 16
Fuel	43,824 68
Interest	4,8190 00

\$162,581 51

CONSTRUCTION.

Paid for labor..... \$5,232 82

Paid for material:

Output as per stock book	5,681 51
Payment on notes	21,600 00

\$32,514 33

Superintendent's Report.

LOWELL, MASS., January 1st, 1904.

To the Lowell Water Board:—

GENTLEMEN:—Following is the Annual Report of the Superintendent of Water Works for the year of 1903:

All the water supplied by the Department during the year was drawn from the Boulevard Wells. The Lower Boulevard Pumping Station was operated 288 days, pumping 1,593,254,456 gallons, and the Upper Boulevard Pumping Station 87 days, pumping 406,781,726 gallons, making a total of 2,000,036,182 gallons obtained from this source for the year. And it is gratifying to note here that these wells were capable of yielding double that quantity were it needed. Analyses of the water made monthly by the State Board of Health shows that it continues to maintain its high standard of purity, and its effect on the health of the City, so far as it depended on drinking water, would continue favorable were it not for the unfortunate escape of polluted river water from the pipes of the Locks & Canals into our mains on the night of the Merrimack Mill fire, July 19th, of which more will be said later on in this report.

Of the 345 2½" wells constituting the source of supply at the Boulevard Well Plant, two have been renewed, eighteen repaired and all of them cleaned twice during the year. A 20" x 14" tee on the main suction pipe at the Lower Pumping Station was found cracked so badly that it admitted large quantities of air into the suction of the pumps, thereby interfering seriously with the work of pumping and causing a material increase in the use of coal. As soon as discovered, the crack in the pipe was covered with cement to stop the air leakage, and a new tee was procured from the Builders Iron Foundry Co. of Providence, and finally inserted in place of the old one. An examination of the old tee showed the break was due to the lightness of the casting, it being only ⅜" thick. The new tee is made much heavier and has a thickness of ¾".

For the purpose of ensuring a constant supply of river water for the boilers, a basin was constructed in the rear of the Lower Pumping Station near the river bank. The river water is conducted to this basin first through a partly open culvert, thence through a 24" pipe. The culvert is made of cement concrete, fitted with stop planks set in grooves of the cement, so as to regulate the flow of water and to hold back the river silt. The basin itself is 16' deep, 24' x 24' wide on the top, with sides sloping inwards towards the bottom. Both the bottom and sides are made of cement concrete. Before the basin was built, water for the boilers was taken from the river through a 6" pipe laid about 40' into the stream; but the service was very unreliable, resulting in the Station being

compelled most of the time to use well water for the boilers. The buildings, machinery and other property of the Department at the Boulevard Well Plant is in good condition, considering the equipment is only temporary and experimental. A much needed and desirable improvement made was raising the floor of the rear part of the coal bin to a level with the front, making it easier for handling the coal. In connection with this work, a passage was made under the coal bin so as to have access to the wells located there at all times without interfering with the coal pile. An extra set of guy wires was attached to the smoke stack, thereby securing it more safely. A new crank had to be purchased for the Forbes Engine in connection with the electric lighting set, the old one having broken.

CENTRALVILLE PUMPING STATION.

As pumping machinery grows older, it is to be expected that more or less repairs become necessary and that various parts of the pumps and connections need renewal. At the Centralville Pumping Station the Morris Engine was used while the daily consumption of water was within its capacity, excepting when out of order, which happened occasionally during the year. After using it twenty-four days it was stopped March 27th, on account of a crack in the valve chamber. It was repaired, started again April 10th, running until May 16th, when a much worse break was found in the valve chamber, causing a slip of about 20% back into the well. It was thought at first that a new valve chamber would be necessary before the engine could

be used again, but it was finally put in running condition by bolting a new sheet of steel so as to cover the opening made. At the present time it is out of commission because of a break in the filling-in piece between the condenser and high pressure cylinder. A new filling-in piece is now being finished from a pattern made in the Department Shop.

The High Duty Worthington Pump at this Station continues to do its work well, although the cost of maintaining it in running condition is increasing continually. The past year the four plungers, one air pump coupling and one of the cylinders on the compensating attachment were in such a bad state that they had to be replaced with new ones. A new foot valve and base plate are also new in stock ready to take the place of the old foot valve and base which are badly worn. The Low Duty Worthington Pump has been run but very little during the year. The great cost of running it, owing to the amount of coal used to pump a million gallons, makes it useful only in case of an accident to the other pumps; so that all things considered, the pumping equipment at this Station is far from satisfactory. The quantity pumped at all of the Pumping Stations and the cost of the same is shown in the City Engineer's Report.

MAIN PIPES, EXTENSIONS, ETC.

While the extension of Street mains, new service pipes laid, and hydrants added, was comparatively small the past year, an unusual amount, however, of relaying, lowering, etc. was done, owing to changing Street grades and lines. Some of this work could

not have been avoided, but much of it also was the result of laying pipe on unaccepted Streets or not fully considering or allowing for the matter of future line and grade when the work was first done. On Gorham Street near the City line, the main pipe for a distance of 200 ft. had to be relocated and lowered, and about 100 ft. of pipe was abandoned because it was in such a position under the Street railroad tracks that it would cost more to remove it than it was worth. The Street surface of Phoebe Avenue was graded so low that about 100 ft. in length of the Street main had to be dropped to prevent freezing. The discontinuance of Poplar Street, which ran through the land of the Lowell Gas Light Co., necessitated the complete removal of the pipe from there. When 10 ft. was taken off the northerly line of French Street, the 6" main, which, according to the new Street line, would be under the sidewalk, was discontinued and a new 8" main laid instead from Bridge to John Street. The lines of Parker Street at the junction of Pine were moved easterly several feet and the main pipe also changed to meet the new conditions.

The widening of Varnum Avenue, while not compelling the Department to move the main pipe, yet caused the resetting of the hydrants and service stops on the street. The most important extension of the year was on Dutton Street connecting Market and Merrimack Streets. For a considerable distance the trench for this pipe was excavated out of solid ledge, adding materially to its cost. All of the extensions voted last year were laid, excepting Webber and Cashin Streets. Delay in receiving the pipe ordered

prevented work on those streets until it was too late in the season. However, they will be attended to as soon as the frost is out of the ground. Beaulieu Street, where an extension is applied for, will, when it is granted, require an extension on West Sixth Street. As the main in that street is only 6" and in the midst of a rapidly growing section, now almost wholly supplied by 6" pipe, I would recommend that instead of extending the present main further on this street, that it all be taken up and replaced with at least a 12" pipe, extending from the terminus of the 12" main opposite the Pumping Station, through West Sixth Street to Lakeview Avenue.

Accompanying this report is a schedule of main pipe laid, hydrants and gates set and the size and locations.

Contained in the appended tables is the size, kind and number of fire hydrants in use to date. Of the thirteen fourway hydrants petitioned for by Agent Hiram F. Mills of the Locks & Canals Co. in behalf of the large corporations, two have been set in place on Market Street and the others are in stock all ready to be located as petitioned for when the season permits of such work. In tapping the main for those set on Market Street it was found necessary to remove the Lowell Electric Light Co.'s wire conduit for the time being. Five post hydrants broken and otherwise rendered beyond repair were condemned and replaced with new ones.

HYDRANTS JANUARY 1st, 1904.

KIND.		² Noz.	³ Noz.	⁴ Noz.	Total
Boston Machine.....	...	...	171	...	171
Chapman .....	...	3	103	50	156
Coffin.....	...	...	1	...	1
Corey.....	...	...	7	...	7
Eddy .....	...	...	32	1	33
Flush	434	...	...	...	434
Glanmorgan .....	...	...	1	...	1
Holyoke .....	...	...	...	1	1
Ludlow .....	...	3	255	3	261
Michigan .....	...	...	46	...	46
O'Brien .....	...	...	1	...	1
Perkins .....	...	...	...	1	1
Walker .....	...	...	1	...	1
Lowrey	11	...	...	...	11
Totals	445	6	618	56	1125

REPORT OF THE WATER BOARD.

PRIVATE HYDRANTS JANUARY 1, 1904.

KIND.		1 Noz.	2 Noz.	3 Noz.	4 Noz.	Total
Boston Machine.....	...	...	1	8	...	9
Chapman .....	...	1	4	1	5	11
Coffin .....	...	...	...	1	...	1
Flush	3	...	...	...	...	3
Kenney .....	...	...	1	...	...	1
Ludlow .....	...	...	18	14	10	42
Michigan .....	...	...	...	3	...	3
Perkins .....	...	...	3	1	...	4
Totals	3	1	27	28	15	74

NEW SERVICES — 1903.

143	$\frac{3}{4}$ " iron tin-lined pipe	5,484 feet
3	1" iron tin-lined pipe	96 feet
2	1 $\frac{1}{2}$ " iron tin-lined pipe	31 feet
1	1 $\frac{1}{2}$ " iron pipe	31 feet
2	2" iron pipe	88 feet
2	4" iron pipe	24 feet
<hr/>		<hr/>
153		5,754 feet
Amount previously laid		433,219 feet
Total now laid		438,973 feet
Total services laid		11,880
Total cutoff at main		819
Total reconnected		58
Total now in use		11,119

SERVICES CHANGED — 1903.

No.	KIND.	CHANGED TO						Total Feet.
		Tin Lined $\frac{3}{4}$ "	Tin Lined 1"	Iron 1"	Iron 1 $\frac{1}{2}$ "	Iron 2"	Lead $\frac{1}{4}$ "	
20	$\frac{3}{4}$ " iron.....	445	...	...	...	...	...	445
1	$\frac{3}{4}$ " iron.....	...	20	...	...	...	...	20
3	1" iron.....	...	...	49	...	...	...	49
1	1" iron.....	31	...	...	...	...	...	31
3	1" iron.....	...	44	...	...	...	...	44
1	1" iron.....	...	...	...	...	27	...	27
1	2" iron.....	21	...	...	...	...	...	21
1	$\frac{3}{8}$ " lead.....	...	...	...	21	...	...	21
2	$\frac{3}{8}$ " lead.....	...	58	...	...	...	...	58
1	$\frac{3}{4}$ " lead.....	...	...	...	...	...	12	12
1	1" lead.....	36	...	...	...	...	...	36
35	Totals	533	122	49	21	27	12	764

PRIVATE METERS RUNNING JANUARY 1, 1904.

SIZES.	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{3}{4}$ "	1"	1 $\frac{1}{2}$ "	2"	Total
Columbia	9	...	...	...	...	9
Crown	1	25	22	2	1	...	51
Desper	3	1	...	...	4
Duplex	1	...	...	...	...	1
Empire	6	...	...	...	...	6
Frost	2	1	...	...	...	3
Hersey	10	1	...	...	...	11
Lambert	9	...	...	...	...	9
Nash	13	2	...	...	1	16
Thomson	1	...	...	...	1
Trident	6	...	...	...	6
Worthington	1	...	3	4
Total	1	75	36	4	1	4	121

METERS RUNNING JANUARY 1, 1904.

SIZE.	$\frac{1}{8}$ "	$\frac{1}{4}$ "	1"	1 $\frac{1}{2}$ "	2"	3"	4"	6"	Total
Columbia	109	4	...	...	...	...	...	...	113
Crown	2701	1573	299	18	19	4	4	2	4620
Desper	21	11	5	...	...	...	...	...	37
Duplex	2	2	4	...	...	...	...	...	8
Empire	225	40	4	...	...	...	...	...	269
Frost .....	...	1	...	...	...	...	...	...	1
Gem .....	...	...	...	...	6	...	4	2	12
Hersey	394	92	8	3	...	...	...	...	497
Lambert	503	72	...	...	...	...	...	...	575
Metropolitan .....	...	1	...	...	...	...	...	...	1
Nash	120	67	42	...	1	...	...	...	230
Niagara	1	1	...	...	...	...	...	...	2
Thomson	1	19	3	...	...	...	...	...	27
Trident	504	30	1	...	...	...	...	...	535
Union	28	7	...	1	...	...	...	...	36
Worthington	121	23	53	68	36	6	3	...	310
Totals	4734	1943	419	90	62	10	11	4	7273



CLEANING DRIVEN WELLS AT LOWER BOULEVARD PUMPING STATION.



New meters set	329
Private meters set	7
Meters out for repairs	782
Meters repaired in cellars	235
Meters reset	470
Meters condemned	28
Meters condemned and replaced with new	28
Meters frozen and burst	121
Meters discontinued	185

FIRE SERVICES.

Besides 1125 public fire hydrants placed at various points in the City for general fire protection, 74 hydrants are in service for private use; they are set on private pipe lines connected with the City system. In all, 103 Fire Services varying from 2" to 10" are laid into the premises of private concerns, supplying stand pipes, sprinklers, hydrants, etc. This number does not include the fifteen 12" and two 8" connections with the Locks & Canals system which were shut off August 20th.

Many of these connections were made and pipes laid in the early years of the Department, especially those with the Locks & Canals Co., but in more recent years the demand for private fire protection has increased considerably, due in a great measure to the encouragement held out by the Insurance Companies in way of smaller premiums or reduced cost to sprinkled risks. So it has become an important question with Water Works officials as to why those receiving the benefit of this extra protection at an increasing expense to the Water Works should not pay for it. But the experience through which the Department passed during the year has brought forward another and more important phase of the question. That is, the menace to the health of the people involved in the connection of the City supply mains with private fire pipes, which may be filled with water taken from a polluted service (as in the case of the Locks & Canals service). It was commonly supposed that check valves on fire service pipes would act as an absolute safeguard against the backing or entering into the

City mains of water from any other source. After the fire in the Merrimack Mills, however, it was demonstrated beyond doubt that it was possible for a check valve to become inoperative and not act as a check, permitting contamination of the City's water service with serious results. Acting under instructions of your Honorable Body, all private fire services were inspected and where there existed connections between the City mains and private or secondary sources of supply that might prove dangerous to the public health, they were discontinued, so that the possibility of infection or contamination from this cause is effectually removed and a recurrence of the epidemic of illness which prevailed in the City during the months of August and September prevented. Further, the connections with the Locks & Canals pipes now shut off will be cut out and entirely severed as soon as practicable in the spring, making it impossible under any circumstances for their water to flow into the City service hereafter.

MISCELLANEOUS WORK.

Every summer, for many years back, a gang known as the "Barrow Men" have been employed by the Department for the purpose of general maintenance work, such as keeping the service, hydrant and gate boxes in condition to use, to evacuate for leaks, to relay street paving where removed by the Department for any reason, to assist in sewer flushing and other emergency work.

This gang is divided into couples, each couple is given a certain section or district to cover and provided with a wheelbarrow containing the necessary tools and wrenches for their work. They are generally men who have worked years for the Department, are more or less skilled and familiar with the location of Street mains, services, gates, etc. Last year in addition to their other work they were required to lay new service pipes and to change old services; on this account the gang was increased from six to ten men. Formerly, when other men were employed on service work, the barrow men were obliged to follow after them and relay the street, gutter or sidewalk pavements. It also occasionally happened that the new service boxes were not properly set and the barrow men were obliged to reset them. Again, it frequently occurred that the service men finished a service an hour or so before the regular time of quitting work, and it not being convenient for various reasons to start another service they went home; whereas, when the barrow men complete a service they can find plenty of other work to do in their regular line. A daily report is made by them and a record kept of their work, from which it appears that during the past year besides the service work, they set 459 curb or sidewalk boxes, 44 gate boxes, 16 hydrant boxes, repaired 40 curb boxes and dug up and repaired 11 leaks. The following work was also done, in which they assisted: 18 private sewers were flushed, 339 hydrants and 115 street gates were inspected and repaired, 178 cases of drinking fountains out of order were attended

to and they were given a general cleaning 13 times. The fountains on Hosford and Pawtucket Squares were moved and reset. Several leaks were caused during the year by sewer work. On Central Street the 12" main had to be hung up by rope in a trench while the sewer was in process of construction; the 12" main crossing the Wamesit Canal on Lawrence Street was broken by the employees of the Lowell Gas Light Co. From time to time, during the summer, a gang was employed in completing the lowering of the suction pipe and wells at the Cook Plant. The pumps at the Cook Wells were also started and run several days to facilitate the work; the water pumped was discharged into the brook. The Filter Gallery, Tunnel and conduits were flushed out and inspected. The painter and carpenter were both kept busy during the year repairing and improving the property of the Department. A sag noticed on both sides of the roof of the boiler room at the Centralville Pumping Station led to an examination which revealed the fact that the 8" x 10" timbers strung diagonally to hold the roof from the point where it was extended in 1891 had dropped down and were almost ready to fall. They were jacked up and fastened in place, but some time the roof should be stripped and new rafters put in where the short rafters which were used on the old roof still remain supported by the 8" x 10" diagonals. The lawns about the Centralville Pumping Station were re-graded in the spring and drains were laid connecting the rain conductors with the sewer, which, with the flower beds set out, made a marked improvement in the appearance of the grounds.

The Street mains were blown off twice during the the year and the hydrants were also blown off in answer to complaints of dirty water, 49 times. The 10" main on Middle Street was raised for a short distance on account of the construction of a subway by A. G. Pollard & Co. under the street; A. G. Pollard & Co. bearing the expense.

PUMPAGE, CONSUMPTION, ETC.

Notwithstanding that the expense of pumping as set forth in the City Engineer's Report shows a large increase per million gallons, the annual consumption of water decreased 168,813,355 gallons and 238 tons of coal less were used last year than in 1902. The increase in the cost of pumping was due to the extraordinary price of coal, it costing \$25,000.00 more for this single item of fuel than it did in 1902. Considering this exceedingly large outlay for coal the Department did well to show a balance on the right side, and this, too, without neglecting any necessary work or allowing the interests of the Department to suffer. To be sure, the construction work of the Department was considerably less than in former years and the amount of supplies purchased, other than coal, was not nearly so great as the year previous.

The remarkable showing of the year was in the daily consumption of water—it being only 5,256,823 gallons—the lowest since 1889. This naturally affected a reduction in the charges and receipts for water to some extent, all of which is for the benefit of the water takers as well as the Department.

CONCLUSION.

In closing I wish to thank the Members of the Board individually and collectively for the consideration shown me during the year.

Respectfully submitted,

ROBERT J. THOMAS,

Superintendent.

LOW SERVICE — WATER PIPES LAID IN 1903.

Streets.	Between What Streets.	Length in Feet					Total
		4-in.	6-in.	8-in.	10-in.	12-in.	
Aiken Ave	Extended northeasterly	..	165	..	..	..	165.0
Andrews	Extended northerly	..	108	..	..	..	108.0
Bertha	Westerly and southerly from Walker	..	270	..	..	..	270.0
Bertram	Extended westerly	..	92	..	..	..	92.0
Boisvert	Easterly from West Sixth	..	405	..	..	..	405.0
Clitheroe	Northerly from Wyman	..	205	..	..	..	205.0
Cumberland Rd	Northerly from Aiken Ave	..	176	..	..	..	176.0
Dutton	Between Market and Merri- mack	..	..	445	..	..	445.0
Dutton	Service to meter supplying B. & M. standpipe	30	..	..	..	..	30.0
Ellsworth	Extended westerly	..	48	..	..	..	48.0
French	Bridge and John	..	..	398½	..	..	398.5
Grace	Northerly from Burgess	..	276	..	..	..	276.0
Hale	Southerly to a proposed new street for C. I. Hood	..	24	..	..	..	24.0
Harrison	Southerly to Oak	..	143	..	..	..	143.0
High	Extended southerly	..	108	..	..	..	108.0
London	Westerly to Quebec	..	171	..	..	..	171.0
New York	Easterly from Riverside	..	..	193	..	..	193.0
Orchard	Northerly from Varnum Ave	..	151	..	..	..	151.0
Parker	Southerly from Pine	..	115	..	..	..	115.0
Quebec	Southerly to London	..	34	..	..	..	34.0
Sanders Ave	Extended southerly	..	281	..	..	..	281.0
Starbird	Connection Varnum Ave. and Waterford	..	209	..	..	..	209.0
Third Ave	Westerly to Waterford	..	273	..	..	..	273.0
Waterford	Easterly to Third Ave	..	68	..	..	..	68.0
Wyman	Easterly to Clitheroe	..	159	..	..	..	159.0
	Hydrants	..	37	..	..	..	37.0
	Laid in 1903	30	3518	1036½	..	..	4584.5
	Less taken out or relaid in Dutton, French, Street off Riverside, Parker and Poplar Streets	110	1063	..	..	..	1173.0
	Total						3411.5

HIGH SERVICE - WATER PIPES LAID IN 1903.

Streets.	Between What Streets.	Length in Feet					Total
		4-in.	6-in.	8 in.	10-in.	12 in.	
Beacon	Extended northerly. ....	..	24	..	..	..	24.0
Haines Ave. .	Westerly from Fairmount ..	..	207	..	..	..	207.0
	Laid in 1903 .....	..	231	..	..	..	231.0
	High Service laid previous to 1903.....	..	..	..	..	..	37653.5
	Total High Service to Jan. 1, 1904 .....	..	..	..	..	..	37884.5

Brought forward	3,411.5 feet
Low Service laid previous to 1903	658,816.5 feet
Total Low Service to January 1, 1904	662,228.0 feet
Total High Service to January 1, 1904.....	<u>37,884.5 feet</u>
Total High and Low Service to January 1, 1904..	700,112.5 feet
Total in miles, 132.59.	

LOW SERVICE — LIST OF STOP GATES SET DURING
THE YEAR 1903.

STREETS.	LOCATION.	4-in.	6-in.	8-in.
		—	—	—
Bertha	10 feet north of south line Bertha Street, on west line Walker Street	1	..	..
Boisvert	12 feet east of west line Boisvert Street, on north line West Sixth Street	1	..	..
Chelmsford ...	On street-car sprinkler standpipe, 164 feet west of east line Chelmsford Street, 54 feet south of south line house No. 148	1	..	..
Chelmsford ...	On street-car sprinkler standpipe, 30 feet west of east line Chelmsford Street, 10 feet north of north line Plain Street	1	..	..
Clitheroe	12 feet east of west line Clitheroe Street, on north line Wyman Street	1	..	..
Coburn	184 feet west of east line Coburn Street, on north line West Sixth Street	1	..	..
Cumberland Rd	23 feet north of south line Cumberland Road, on east line Aiken Avenue	1	..	..
Cumberland Rd	15 feet north of south line Cumberland Road, on West line Aiken Avenue	1	..	..
Dutton	41.7 feet east of west line Dutton Street, on north line Market Street	1	..	..
Dutton	72.8 feet northeasterly from corner depot, and 91.8 feet north-westerly from corner Locks & Canals gatehouse	1	..	..
Dutton	On service to Boston & Maine R. R. standpipe, 45 feet west of depot	1	..	..
*French	14 feet south of north line French Street, 17 feet east of west line Bridge Street	1	..	..
Harrison	16.8 feet east of west line Harrison Street, on north line Oak Street	1	..	..
*Lakeview Ave	15.2 feet west of east line Lakeview Avenue, on north line West Street	1	..	..
London	13 feet north of south line London Street, on east line Quebec Street	1	..	..
Market	On hydrant connection, at old Card Clothing Building, 64 feet from hydrant	1	..	..
Market	On hydrant connection, at Casto Theatre, 84 feet from hydrant	1	..	..
Moore	144 feet south of north line Moore Street, 0.7 foot east of east line Andrews Street	1	..	..
New York	12 feet south of north line New York Street, 1 foot west of east line Riverside Street	1	..	..
*Oak	17 feet south of north line Oak Street, on east line High Street	1	..	..
Orchard	12 feet west of east line Orchard Street, on north line Varnum Avenue	1	..	..
*Parker	12 feet west of east line Parker Street, on South line Pine Street	1	..	..
Varnum Ave ..	234 feet south of north line Varnum Avenue, on easterly line Starbird Street	1	..	..

*Gates taken out or relocated—Lakeview Avenue, opposite No. 637; Parker Street, corner Pine; French Street, corner Bridge; Street off Riverside, near New York Street; Oak Street, corner High Street.

HIGH SERVICE — GATES SET DURING 1903.

STREETS.		4-in.		
		4-in.	6-in.	8-in.
Fairmount	12 feet east of west line Fairmount Street, on north line Haines Street		1	
Haines	12 feet south of north line Haines Street, on west line Fairmount Street		1	

LOW SERVICE — LIST OF HYDRANTS SET DURING
THE YEAR 1903.

STREETS.	LOCATION.
Andrews.....	Westerly side, on pipe terminus.
Dix	Post hydrant replaced flush hydrant, corner Gorham and Dix Streets.
Dutton	Southeasterly side, 42 feet from depot.
French	Northerly side, 135 feet west of Bridge Street. (Old flush taken out.)
Lincoln.....	Post hydrant replaced flush, southerly side.
Market	Northerly side, corner Shattuck, at Casto Theatre.
Market	Northerly side, corner Shattuck, at old Card Clothing Building.
Meadowcroft ..	Easterly side, corner St. James Street.
Third Avenue ..	Northerly side, about 405 feet east of Waterford Street.

PROPERTY AND TOOLS AT PUMPING STATION No. 1.

One high duty Worthington engine, 1 low duty Worthington engine, 464 tons coal, 1 Worthington engine for high service, 1 Morris engine, 11 wrenches for high duty engine, 11 wrenches for low duty engine, 12 wrenches for Morris engine, 1 electric engine and switchboard, 16 wrenches for electric engine, 1 set dynamo wrenches, 2 30" slings, 1 hand switchboard for lights, 1 jacket pump, 122 brass springs for Worthington Engine, 1 telephone, 1 telemeter, 4 outer globes for arc lights, 5 inner globes, 1 set drawings for high duty engine, 1 compensating cylinder for high duty engine, 7 steel springs for Morris engine, 2 feed pumps, 1 set Chesterton packing tools, 1 barometer, 3 thermometers, 2 indicators, 1 clock, 1 oil filter, 1 oil cabinet, 1 ledger, 1 desk, 1 log book, 1 oil can, 6 tin oil cans, 4 one gallon oil cans, 1 copper oil can, 19 gallons Magnet engine oil, 50 gallons Paramount cylinder oil, 4 gallons Eagleine cylinder oil, 2 mops, 10 lbs. leather, $\frac{1}{2}$ gallon Daggett's metal polish, 1 table, 1 garden rake, 1 lawn mower, 12 assorted files, 3 wood chisels, 2 glands, 1 window brush, 1 claw hammer, 2 iron pails, 6 center punches, 3 five gallon oil cans, 4 iron oil cans, 5 brass oil cans and stand, 1 old oiler, 4 Keystone oil cups, 5 Dryfus self-oilers, 5 assorted oilers, 3 oil dishes, 6 cold chisels, 45 assorted valve plates, 60 assorted brass springs, 16 5" old rubber valves, 1 sickle whetstone, 3 old pressure valves, 2 steel keys for pumps, 1 2" Jenkins valve, 47 $\frac{1}{2}$ " x 12" carbons, 1 gouge chisel, 6 cold chisels, 2 hand ratchets for drills, 3 steel wedges, 5 steel punches, 1 small pinch bar, 1 large pinch bar, 2 hand brushes, 2 floor brushes, 4 caulking sets, 20 machine sets, 5 lbs. cop waste, 1 waste can, 1 dust pan, 2 lanterns, 1 tag rope, 1 small block and falls, 2 extension lamps, 1 level, 1 24" flange $\frac{1}{2}$ turn, 1 24" monkey wrench, 1 18", 2 14", 1 12", 1 8", 2 small screw jacks, 2 large screw jacks, 1 small pipe tongs, 2 draw screws, 6 ratchet drills, 2 screw drivers, 1 hack saw, 2 spanners, 1 hammer, 1 sledge hammer, 2 pairs steps, 1 machinist hammer, 1 20 ft. ladder, 40 1" x 1 $\frac{1}{4}$ " iron bolts, 2 clothes closets, 2 tool closets, 1 desk, 1 pair 6" clamps, 1 brass hydrant,

1 hose rack, 1 length of hose, 2 large extension lamps, 1 square-pointed shovel, 2 ratchet drill stocks, 1 set differential blocks, 1 hoe, 2 heavy chains, 2 3 ft. wooden horses, 5 assorted bits, 1 gate wrench, 1 pair rubber boots, $\frac{1}{2}$ bbl. soap, 1 pair skids, 7 ft. galvanized iron pipe, 2 14" Stillson wrenches, 1 8", 2 6", 2 screw drivers for Morris engine, 1 copper pump, 15 socket wrenches, 60 assorted brass springs, 45 iron washers, 20 eye bolts, 35 $1\frac{1}{4}$ " x 5" bolts, 1 2" x 3" socket wrench, 3 pipe taps, 12 drills, 1 L. W. W. stamp, 1 steel square, 2 lbs. plumbago, 3 bit stocks, 6 lbs. Chesterton gum core packing, $13\frac{1}{2}$ lbs. Chesterton $\frac{3}{4}$ " square flax packing, $13\frac{3}{4}$ lbs. Eagleine $\frac{3}{4}$ " square flax packing, $11\frac{1}{2}$ lbs. Eagleine $1\frac{1}{4}$ " gum core packing, $53\frac{1}{2}$ lbs. Eagleine ring packing, 3 lbs. flax packing, 7 lbs. $\frac{1}{2}$ " and $\frac{5}{8}$ " square pump packing, 22 lbs. wire braided $\frac{3}{4}$ " square packing, 42 lbs. Garlock ring packing, $38\frac{1}{2}$ lbs. Knowlton ring packing, $8\frac{1}{2}$ lbs. Lebron packing, 3 lbs. asbestos valve packing.

BOILER ROOM.

Four boilers, 2 boiler feed pumps, 2 sets fire tools, $\frac{1}{2}$ gallon Daggett's polish, 1 12" monkey wrench, 50 ft. $\frac{3}{4}$ " rubber hose, 1 bench, 1 broom, 2 coal hammers, 2 coal scoops, 1 30 ft. hay scales, 30 ft. extra heavy steam hose, 1 floor brush, 1 brass dutchman, 2 tube scrapers, 4 side bars for grates, 10 old sections for grates, 1 hose rack, 1 length fire hose, 1 brass nozzle, 1 clock, 1 desk, 1 platform scales, 2 dippers, 1 14 ft. ladder, 2 step ladders, 2 chairs, 2 coal shovels, 1 clothes closet, 1 electric lamp.

PROPERTY AND TOOLS AT PUMPING STATION No. 2.

Two Dean steam pumps, 1 feed pump, 3 boilers, 1 condenser, 1 air pump, 1 water trap, 2 8" air chambers, 1 water pressure gauge, 3 vacuum gauges, 9 $\frac{3}{4}$ " gauge glasses, 2 $\frac{1}{2}$ " gauge glasses, 5 glasses for oil cups, 3 60 gallon oil tanks, 50 gallons kerosene oil, 25 gallons cylinder oil, 1 gallon engine oil, $\frac{1}{2}$ gallon lard oil, 1 brass oil can, 3 spring oil cans, 3 drip pans, 1 24" monkey wrench, 1 8", 1 6", 1 24" Stillson wrench, 1 16", 1 12",

1" iron pipe, 1 2" iron nipple, 2 $\frac{1}{2}$ ", 2 1", 3 $\frac{3}{4}$ ", 2 $\frac{1}{2}$ ", 1 12" flange, 1 6", 1 6" x 2", 12 windows shutters, 6 ft. 1" iron rod, 90 ft. cable iron, 10 iron bars and clamps for window shutters, 14 brass plates for feed pumps, 61 brass valve plates, 45 brass valve stems, 6 brass stud bolts, 10 bronze plates for water piston, 6 lbs. Eureka packing, 19 lbs. Knowlton's ring packing, 2 lbs. Garlock ring packing, 20 lbs. $\frac{7}{8}$ " square pump packing, 12 lbs. $\frac{5}{8}$ " square pump packing, 5 lbs. Jenkins sheet packing, 15 lbs. rubberbestos sheet packing, 10 lbs. rainbow packing, 2 lbs. sheet rubber packing, 12 lbs. gasket packing, 1 lb. gasket tubing for manhole, 2 lbs. gasket tubing for hand hole, 2 lbs. braided hemp, 10 lbs. flax, 1 wire brush, 1 steel scraper, 1 pair shears, 2 1 gal. oil cans, 1 $\frac{1}{2}$ gal. oil can, 1 brass piston for air pump, 1 brass connection, 1 tunnel, 8 eye bolts, 1 brass pump valve and studs complete, 4 lbs. oxalic acid, 1 steel set for pumps, 1 small clamp for $\frac{3}{4}$ " pipe, 2 crow bars, 1 steel pinch bar, 450 ft. 4" x 4" spruce, 80 ft. 8" x 8" wooden blocking, 50 ft. 3" plank-ing, 350 ft. 2" sheathing, 1 1 $\frac{1}{2}$ " iron plug, 1 1", 2 $\frac{3}{4}$ ", $\frac{1}{2}$ ", $\frac{1}{4}$ ", 1 1" brass plug, 1 $\frac{1}{2}$ " brass plug, 1 small mirror, 1 ink stand, 3 lbs. old brass, 500 lbs. old iron.

PROPERTY AND TOOLS AT PUMPING STATION No. 4.

LOWER STATION.

Three Knowles pumps, 2 boiler feed pumps, 2 air pumps, 1 electric engine, 3 50 gallon oil tanks, 4 boilers, 1 condenser, 1 heater, 40 gallons cylinder oil, 2 gallons engine oil, 25 gallons kerosene oil, 1 oil filter, 1 multiple oiler, 2 oil cans, 6 S wrenches, 1 spring oil can, 1 gauge glass cutter, 1 24" monkey wrench, 2 12", 1 8", 1 24" Stillson wrench, 1 30", 1 14", 48 new brass valve studs, 35 brass springs for pump valves, 7 lbs. Jenkins sheet packing, 2 2" flanges, 1 8" flange, 4 carbons for dynamo, 5 seats for Jenkins valves, 1 motor and switch board, 1 incandescent lamp extension, 3 small incandescent lamps, 6 brass stud bolts, 1 small chain tongs, 1 large chain tongs, 1 tunnel, 1 oil tray and stand, 1 floor brush, 1 dust pan, 26 pump wrenches,

5 spanner wrenches, 6 brass rods for gauge glasses, 12 socket wrenches, 6 packing tools, 20 lbs. sal soda, 2 lbs. $\frac{1}{4}$ " gasket tubing, $\frac{1}{2}$ lb. $1\frac{1}{2}$ " Chesterton packing, 1 box Knowlton oval packing, 25 lbs. caustic soda, 1 gallon lard oil, 30 lbs. scrap rubber, $1\frac{1}{2}$ gallons Daggett's polish, 6 $\frac{3}{4}$ " gauge glasses, 124 Jenkins rubber valves, 12 $\frac{3}{4}$ " iron stud bolts, 5 fuses for electric light, 4 assorted bits, 8 copper connections for switchboard, 2 large lamp chimneys, 3 $2\frac{1}{2}$ " vacuum gauges, 11 $4\frac{1}{2}$ " rubber valves, 2 inner globes for arc light, 1 pair rubber boots, 10 $\frac{3}{4}$ " gauge glasses, 6 $\frac{3}{4}$ " gauge glasses, 3 $1\frac{1}{2}$ " plugs for boilers, 1 new steam trap, 3 valve rods, 3 pet cocks, 1 drill ratchet, 3 $\frac{1}{4}$ " bushings, 1 pair pliers, 1 pair snips, 1 plumb ball, 1 $1\frac{1}{4}$ " tap, 2 $\frac{1}{2}$ " drills, 1 $\frac{3}{8}$ ", 1 $1\frac{1}{2}$ ", 26 $\frac{1}{2}$ " gauge glasses, 4 $5\frac{1}{2}$ " x $\frac{1}{2}$ " rubber valves, 14 $4\frac{1}{2}$ " x $\frac{1}{2}$ ", 3 $6\frac{1}{2}$ " x $\frac{1}{2}$ ", 2 lbs. wiping solder, 5 lbs. metallic packing, 12 old well points, 2 telephones and extensions, $\frac{1}{2}$ lb. Eagleline ring packing, 2 lbs. asbestos rope packing, 20 lbs. $\frac{3}{4}$ " square pump packing, $1\frac{1}{2}$ lbs. Italian flax packing, 4 lbs. mop waste, 1 mop, 1 clock, 1 sand screen, 1 cross-cut saw, 2 hand saws, 1 sod cutter, 12 old well points, 2 lights glass, 7 lengths $5\frac{1}{2}$ " soil pipe, 7 lengths $6\frac{1}{2}$ " soil pipe, 5 old gate boxes, 15 air chambers, 25 ft. $3\frac{1}{2}$ " extra heavy pipe, 75 ft. $2\frac{1}{2}$ ", 16 ft. $1\frac{1}{2}$ " lead lined pipe, 6 $2\frac{1}{2}$ " flanges, 4 old sections for grates, 1 new section for fire box, 1 lantern, 2 well-driving machines complete, 1 $\frac{3}{4}$ " corporation cock, 4 ft. $\frac{3}{4}$ " brass pipe, 1 solder iron, 5 old B. & H. lamps, 1 desk, 3 chairs, 1 ledger, 6 old coal shovels, 1 coal hammer, 1 axe, 10 ft. $8\frac{1}{2}$ " x $8\frac{1}{2}$ " lumber, 50 ft. cable rope, 10 clamps for well-driving machine, 1 anvil, 2 pairs tongs, 1 Reed pipe vise and bench, 1 $5\frac{1}{2}$ ft. bench and vise, 1 platform scales, 1 $30\frac{1}{2}$ ft. hay scales, 1 wooden maul, 1 blacksmith forge, 5 $1\frac{1}{2}$ gallon oil cans, 1 old furnace, 50 ft. $\frac{3}{4}$ " rubber hose, 1 water pail, 1 ratchet drill, 1 long-handle brush, 1 dust pan, 1 prick punch, 60 ft. $6\frac{1}{2}$ " x $6\frac{1}{2}$ " timber, 10 old posts, 1 Walworth die stock and set of dies, 1 Armstrong die stock and dies complete, 2 pipe cutters, 2 pairs large pipe tongs, 1 steel scraper, 3 steel wedges, 1 grindstone, 1 lawn mower, 1 machinist's hammer, 20 washers for pitcher pumps, 2 boats, 6 oars, 3 sand screens, 1 gravel screen, 1 scythe and snath, 4 hangers for lamps, 3 lbs. asbestos covering, 25 lbs. lime, 2 bags asbestos, 180 old rubber valves, 25 lbs. old

brass springs, 12 brass valve plates, 1 gate plan, 1 small desk, 10 wooden brackets for staging, 10 iron bolts, 145 pieces $2\frac{1}{2}$ " well pipe, 2 copper weights, 2 wire brushes for wells, 1 12" wooden head for pipe, 2 lbs. leather, 1 6" well head, 34 2" iron couplings, 1 3", 2 $2\frac{1}{2}$ ", 3 $1\frac{1}{4}$ ", 45 $2\frac{1}{2}$ ", 2 1" brass couplings, 2 3" iron nipples, 7 $2\frac{1}{2}$ ", 20 2", 1 $1\frac{1}{2}$ ", 18 1", 25 $\frac{3}{4}$ ", 9 $\frac{1}{4}$ ", 12 $\frac{3}{4}$ " brass nipples, 2 $\frac{1}{2}$ ", 2 2" iron elbows, 2 $1\frac{1}{2}$ ", 2 1" x $1\frac{1}{2}$ ", 1 1", 7 $\frac{3}{4}$ ", 4 $\frac{1}{2}$ ", 7 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ " x $\frac{3}{8}$ ", 1 3" x $2\frac{1}{2}$ ", 1 2" lead lined elbow, 2 $1\frac{1}{2}$ ", 1 $\frac{3}{4}$ ", 1 $2\frac{1}{2}$ " brass elbow, 1 $\frac{1}{2}$ ", 4 $\frac{1}{4}$ ", 1 2" x $1\frac{1}{2}$ " iron bushing, 1 3" x 2", 1 2" x 1", 1 $1\frac{1}{4}$ " x $\frac{3}{4}$ " brass bushing, 1 2" x 1", 1 $2\frac{1}{2}$ " iron cap, 1 2", 4 $1\frac{1}{2}$ ", 1 12", 1 3" iron tee, 1 3" x $1\frac{1}{2}$ ", 1 2" x $1\frac{1}{2}$ ", 1 $1\frac{1}{2}$ ", 8 1", 2 $\frac{3}{4}$ ", 6 $\frac{3}{4}$ " x $\frac{1}{2}$ ", 4 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ ", 1 2" union, 1 $1\frac{1}{2}$ ", 1 $1\frac{1}{4}$ ".

UPPER STATION.

Two 3 million gallon Worthington pumps, 1 air pump, 2 boiler feed pumps, 2 boilers, 1 10" monkey wrench, 6 S wrenches, 4 open end wrenches, 8 socket wrenches, 1 offset wrench, 1 valve wrench, 1 $\frac{5}{8}$ " side wrench, 1 5 gallon oil can, 1 2 gallon, 1 1 gallon, 6 large oil pans, 5 small oil pans, 1 small oil cup, 2 coal scoops, 2 packing hooks, 1 telephone, 1 plan of filter gallery conduit and pumping station, 1 desk, 1 plan of Boulevard wells, 1 hose rack, 1 nozzle, 1 length fire hose, 100 ft. $\frac{3}{4}$ " rubber hose, 15 brass springs for pumps, 2 $\frac{5}{8}$ " eye bolts, 3 $\frac{1}{4}$ ", 1 box invincible metal polish, 2 old coal shovels, 1 50 gallon oil tank, 2 sight feed oil glasses, 4 chairs, 2 tunnels, 2 gallons engine oil, 2 gallons cylinder oil, 2 brass oil trays, 1 18 ft. ladder, 1 11 ft., 1 7 ft., 2 lanterns, 1 dust pan, 12 bolts, 17 $\frac{3}{4}$ " iron washers, 2 steel plates for pumps 5" square, 3 $\frac{1}{2}$ lbs. brimstone, 11 brass valve sets, 12 brass binders, 50 iron bolts, washers and nuts, 3 $\frac{1}{2}$ " x 12" carbons, 5 machine drills, 2 iron brackets for pumps, 1 diamond point, 3 pitcher pumps, 1 B. & H. lamp complete, 25 lbs. Jenkins sheet packing, 15 lbs. sheet rubber packing, 3 lbs. Italian flax, 8 $\frac{1}{2}$ lbs. Knowlton ring packing, 15 lbs. 1" square pump packing, 3 lbs. $\frac{3}{4}$ ", 5 lbs. $\frac{1}{2}$ ", 1 $\frac{1}{2}$ lbs. $\frac{1}{4}$ ", 3 new improved oil cups, 1 broom, 25 lbs. old brass, 3 lantern globes, 1 coal barrow, $\frac{1}{2}$ box Putz Pomade, 1 coal barrow, 1 lb. $\frac{1}{2}$ " gum

core packing, 1 lb. $\frac{1}{4}$ ", 1 $\frac{3}{4}$ " iron elbow, 4 $\frac{1}{2}$ ", 1 $\frac{1}{2}$ " x $\frac{3}{8}$ ", 1 $\frac{1}{2}$ " x $\frac{1}{4}$ ", 3 $\frac{1}{4}$ " brass elbows, 1 cold chisel, 1 caulking set, 4 $\frac{1}{4}$ " gauge glasses 17" long, 1 2 $\frac{1}{2}$ " vacuum gauge, 50 ft. $\frac{3}{4}$ " rubber hose, 1 scraper, 1 wooden rake, 1 step ladder, 1 set fire irons, 1 14 ft. ladder, 1 22 ft. ladder, 1 stone drill, 1 iron spoon, 1 gate wrench, 1 funnel, 1 coal barrow, 3 iron pails, 1 large pipe tongs, 1 18" monkey wrench, 1 dust brush, 1 dipper, 1 spring oil can, 2 hand hole plates, 1 pipe wrench, 1 pick, 1 lb. nails, 1 wooden mallet, 2 lanterns, 2 fusible plugs, 2 clothes closets, 2 old Worthington counters, 1 sickle.

CUSHING BARN.

One portable engine and boiler, 1 set fire tools, 1 mortar bed, 1 large wooden gate, 1 small wooden horse, 1 grindstone, 1 horse rake, 1 2 horse mowing machine, 1 large stone cover for well, 1 centrifugal pump, 25 tons hay, 85 ft. 8" x 6" wooden blocking, 110 ft. 8" x 8", 50 ft. 10" x 8", 10 ft. 12" x 8", 40 ft. 14" x 10", 450 ft. 4" x 4" short lengths.

PROPERTY AND TOOLS AT FILTER BASIN HOUSE.

One gate wrench, 1 pick, 1 ice hook, 1 ice rake, 2 ice chisels, 1 dipper, 1 iron rake, 1 mortar tub, 2 square-pointed shovels, 25 ft. $\frac{1}{2}$ " rope, 2 L. W. W. fence signs.

BODWELL GATE HOUSE.

One iron rake, 1 sidewalk wrench, 1 broom, 1 gate wrench, 1 1" cellar cork, 1 nozzle, 8 ft. 1 $\frac{1}{4}$ " iron pipe.

INLET CHAMBER HOUSE.

One wheelbarrow, 2 small iron blocks and falls, 1 small iron block, 14 screens, 1 gate wrench, 1 sidewalk wrench, 1 fork wrench, 5 iron wedges, 1 round-pointed shovel, 1 pick, 3 square-pointed shovels, 2 wooden snow shovels, 1 broom, 1 iron rake, 2 ice hooks, 1 long-handle ice rake, 1 ground hoe, 50 ft. $\frac{3}{4}$ " rubber hose and nozzle.

PROPERTY AND TOOLS AT RESERVOIR.

Three lawn mowers, 1 wooden rake, 1 iron rake, 1 monkey wrench, 1 long-handle hoe, 2 lanterns, 1 ice chisel, 1 broom, 1 iron pail, 1 round-pointed shovel, 2 square-pointed shovels, 1 hose reel, 150 ft. $\frac{3}{4}$ " rubber hose, 1 garden wheelbarrow, 1 buck saw, 1 hand saw, 1 sprinkling pot, 1 boat and pair of oars, 1 turf cutter, 1 pair sheep shears, 1 sidewalk wrench, 1 table, 1 chair, 1 crowbar, 1 long-handle skimmer, 2 thermometers, 1 floor brush, 1 oil can, 8 screens.

PROPERTY AND TOOLS AT STABLE, HAMPSHIRE ST.

Seven horses, 6 tons hay, 500 bushels oats, 1400 lbs. rye straw, 50 lbs. shorts, 2 pung sleighs, 5 traverse runner sleighs, 1 light sleigh, 4 feed bags, 1 hay cutter, 1 single truck, 1 Goddard buggy, 1 dump cart, 7 stable blankets, 4 mane brushes, 1 wire brush, 4 brooms, 13 hay forks, 1 chamois skin, 8 sponges, 2 wagon jacks, 4 whips, 8 street blankets, 1 wolfskin robe, 3 lap robes, 1 dogskin robe, 2 wagon tops, 4 hitch ropes, 2 sunshades, 2 umbrellas, 9 halters, 7 storm covers, 1 pint No. 92 axle oil, 10 lbs. axle grease, 4 galvanized iron pails, 2 hoof picks, 1 floor scraper, 7 leather surcingles, 2 stall hooks, 1 pair rubber boots, 1 pair clippers, 1 screw driver, 1 set double harness, 2 sets light driving harness, 7 sets single harness, 2 sets old harness, 200 lbs. rock salt, $\frac{3}{4}$ bbl. Standard food, 2 4 qt. measures, 1 hay hook, 2 hose racks, 2 lengths hose, 2 nozzles, 6 fly nets, 1 string sleigh bells, 2 Democrat wagons, 1 saddle pad, 25 ft. $\frac{3}{4}$ " rubber hose, 4 brooms, 50 ft. 1" rubber hose, 6 wagons, 10 wooden rakes, 7 scythes and snaths, 2 mowing machine knives, 4 whetstones, 1 hay rake, 2 qts. edge blacking, 2 qts. neatsfoot oil, 7 lbs. harness leather, 10 hame snaps, 3 pairs $1\frac{1}{2}$ " shaft tips, 6 $1\frac{1}{2}$ " nickel rings, 1 doz. rings, 6 balls wax, 8 balls thread, 1 boot.

PROPERTY AT SUPERINTENDENT'S OFFICE.

One roll top desk, 1 desk, 1 card cabinet, 1 set drawers and bookcase, 1 small bookcase, 1 Howard clock, 2 gate plans, 1 map city of Lowell, 1 diagram, 3 bill files, 1 water gauge, 1 test gauge, 2 inkstands, 3 chairs, 1 letter press, 1 Webster dictionary, 1 service book, 1 small scale, 1 hat rack, 4 tape lines, 50 ft, 1 $\frac{1}{4}$ " tap, 1 $\frac{1}{8}$ ", 1 $\frac{3}{8}$ ", 4 $\frac{1}{2}$ doz. twist drills various sizes, 1 $\frac{3}{4}$ " twist drill, 1 $\frac{1}{4}$ " die, 2 1", 6 $\frac{3}{4}$ ", 2 L. W. W. stamps, 1 test gauge, 2 balls lamp wick, $\frac{1}{2}$ doz. hack saws, 1 doz. 12" files, 1 doz. clips for $\frac{3}{4}$ " hose.

PROPERTY AND TOOLS AT MACHINE SHOP.

One 10 ft. engine lathe, 1 7 ft., 1 5 ft. speed lathe, 1 6" brass finishing lathe, 1 6" pipe cutter, 1 upright drill, 1 emery wheel, 1 shaper, 2 solder furnaces, 2 independent chucks, 10 lathe dogs, 20 reamers, 10 twist drills, 8 flat drills, 12 flat chucking drills, 42 turning drills, 10 steel arbors, 1 1 $\frac{1}{2}$ " machine drill, 1 1 $\frac{1}{4}$ " 1 1", 2 meter reamers, 27 taps, 3 tapping machines, 1 hand vise, 2 Scotch drills, 4 bench vises, 1 Howe scales, 1 Knowles platform scales, 44 tools for brass lathe, 15 cast iron chucks, 1 set hand chasers, 1 set broachers, 28 tools for brass work, 15 files, 3 soldering irons, 1 bit stock and set of bits, 1 belt punch, 1 set steel figures, 1 pair cut nippers, 1 6" Smith tapping machine with rubbers, 2 gallons naphtha, 2 hack saws, 1 pair scissors, 1 pair snips, 1 saw set, 2 naphtha lamps, 1 L. W. W. stamp and tools for sealing fire service, 3 pairs steps, 1 pipe tap, 2 mops, 1 chair, 2 hose racks, 2 lengths hose, 2 nozzles, 4 stools, 1 mirror, 1 clothes closet, 1 waste can, 1 ratchet stock and set of dies, 1 set washer cutters, 5 wood chisels, 4 wrenches for meter work, 1 12" monkey wrench, 1 8" monkey wrench, 8 lathe wrenches, 1 14" Stillson wrench, 1 Read tapper for engine valve, $\frac{1}{4}$ gross cork packing for meters, 6 spring oil cans, $\frac{1}{4}$ gross 2 $\frac{3}{8}$ " bolts, $\frac{1}{4}$ gross 3 $\frac{1}{2}$ " x $\frac{1}{16}$ " bolts, 1 nail puller, 2 nipple holders 1" x 1 $\frac{1}{4}$ ", 1 switch-board, 12 steel sets, 1 carpenter's plane, 1 map of water mains,

1 clock, 15 lbs. sheet lead, 50 lbs. bolts for hydrants, 17 assorted drills, 3 taps, 1 S wrench, 4 chisels, 1 bit stock, 1 dry tapping machine, 1 monkey wrench, 10 feet of chain for fountains, 1 reamer, 1 set chain falls, 2 clamps, 6 bottoms and plates for hydrants, 1 level, 2 lanterns, 1 brass dutchman, 1 4" standpipe, 1 large Smith tapping machine, 1 marline spike, 1 tool box and set of tools for hydrants, 1 pair rubber boots, 1 bench and vise, 1 dipper and tunnel for thawing out hydrants, 1 Lowry hydrant wrench, 2 work benches, 2 disks, 1 vise, 5 old flush hydrants, 3 parts of hydrant tester.

PROPERTY AND TOOLS AT PAINT SHOP.

Fifty gallons graphite paint, 5 gallons elastic paint, 50 gallons raw linseed oil, 3 gallons turpentine, 2 gallons varnish, 4 gallons creosote, 9 gallons wood filler, 100 lbs. white lead, 25 lbs. color, 25 lbs. putty, 5 lbs. French yellow, 20 lbs. sylvan green, 25 lbs. bronze, 200 lbs. dry red, 175 lbs. whiting, 1 lb. aluminum, 1½ lbs. gold bronze, 1 whitewash brush, 8 ladders, 2 pairs trestles, 1 stove, 1 stepladder, 1 oil barrel, 1 work bench, 4 10 gallon oil cans, 11 5 gallon, 20 1 gallon, 1 galvanized iron pail, 2 clothes closets.

BLACKSMITH SHOP.

Three anvils, 18 pairs tongs, 1 forge and bellows, 1 steel square, 10 hand punches, 1 saw, 2 vises, 1 sledge hammer, 1 work bench, 3 L. W. stamps, 1 closet, 1 coal shovel, 1 coal hod, ½ ton coal, 250 lbs. machine steel, 180 lbs. common iron, 1 broom, 1 spanner, 7 spoons, 100 fire bricks, 175 ft. steel drills, 12 heading tools, 50 lbs. old metal, 1 pair dividers, 75 picks, 25 lbs. small steel drills.

PROPERTY AND TOOLS AT FOUNDRY.

Fifteen box flasks, 1 moulder's trough, ½ ton moulder's sand, 3 riddles, 1 pair rammers, 1 core bench and vise, 1 bellows, 1 watering pot, 200 cores, 1 core oven, 1 moulder's shovel, 2

trowels, 1 brush, 2 new crucibles, 1 old crucible, 1 melting furnace, 1 pair crucible tongs, 1 bale, 1 pair melting tongs, 1 steel tip melting bar, 1 iron ingot, 8 plaster of Paris pattern matches, 25 lbs. core sand, 3 lbs. tin tubing, $2\frac{1}{2}$ lbs. tin, $\frac{1}{4}$ bbl. moulder's sand, 1 floor brush, 1 wire brush, 20 lbs. old metal, 10 lbs. brass chips, 100 lbs. coal, 100 core wires, 1 coal shovel.

CARPENTER SHOP.

500 ft. kyanized 2" spruce lumber, 40 ft. birch, 60 ft. cypress, 12 lbs. 8d nails, 6 8d iron nails, 10 lbs. 10d iron nails, 2 lbs. $1\frac{1}{4}$ " brads, 2 lbs. 1", 1 lb. $\frac{3}{4}$ ", 1 gross $1\frac{1}{2}$ " wire screws No. 10, $\frac{1}{2}$ gross 4", 1 gross 1", $\frac{1}{2}$ gross 2", 4 window catches, 2 cupboard catches, $\frac{1}{2}$ doz. hooks and staples, 1 turning lathe and set of tools, 1 jig saw, 1 circular saw, table, 5 saws, 1 20 ft. carpenter's bench, 1 10 ft. straight edge, 1 7 ft., 2 iron patterns for hydrant boxes, 2 for gate boxes, 14 saw files, 1 pair 6 ft. steps, 1 pair 8 ft.

PROPERTY AND TOOLS AT STOCK ROOM.

1274 lbs. pig lead, 1 set brass stencils, 6 ladles, 2 trowels, 143 lbs. $\frac{3}{4}$ " lead pipe, new, 40 lbs. $\frac{3}{4}$ " lead pipe, old, $\frac{1}{4}$ bbl. salt, 262 lbs. fire clay, 60 lbs. sal soda, 16 lbs. asbestos, 6 ft. 2" asbestos pipe covering, 4 old plungers for engine, 1 freight truck, 1 coal barrow, 6 levels, 2 rolls iron wire, 6 lbs. plumbago, 3 electric batteries, 2 squarehead wrenches, 2 stone hammers, 1 mason's hammer, 2 spiking hammers, 8 sledge hammers, 8 striking hammers, 11 caulking hammers, 4 paving hammers, 2 claw hammers, 50 lbs. iron nuts and washers, 2 axes, 4 open machine wrenches, 100 lbs. Keystone grease, 35 lbs. pig copper, 2 bullhead points, 2 small drills, 10 pipe wedges, 4 yarning irons, 9 stone points, 1 doz. leather washers for pumps, 2 pipe trucks, 3 brass force pumps, 125 ft. block tin tubing, 200 ft. $\frac{1}{4}$ " tin tubing, 3 parts of hydrant test gauge, 1 cock for hose connection, 4 ft. 2" asbestos pipe covering, 5 ft. $1\frac{1}{4}$ ", 8 brass guards for pipe machine, 1 stand for grinding cutters, 2 bench pipe vises, 1 wagon vise, 1 vise and stand for cutting 6" pipe, 1 electric

motor and pump complete, 1 plain slide valve and pulley, 2 18" engine bolts, 1 3" strainer for feed boilers, 1 shaft clutch, 18 pulley castings, 2 electric indicators, 1 wagon wrench, 6 round gate covers, 13 square gate covers, 2 sets wooden blocks and falls, 2 sets iron blocks and falls, 1 set wooden blocks, 8 furnaces for melting lead, 6 lead pots, 4 bails for lead pots, 3 keys for sidewalk boxes, 4 old driven well points, 39 caulking sets, 97 shims, 23 diamond points, 20 cold chisels, 8 sidewalk wrenches, 3 fork wrenches, 5 scoops, 9 flush hydrant wrenches, 25 gallons lard oil, 10 lbs. tallow, 9 No. 66 Macbeth chimneys, 5 No. 10, 7 paving mauls, 30 iron mauls, 6 wooden mauls, 4 old pails, 6 galvanized iron pails, 64 lantern globes, 1 top for marine pump, 22 diaphragms for marine pumps, 11 lbs. mop waste, 400 lbs. cop waste, 50 4 ft. exploders, 12 pipe cutters, 5 keys for sidewalk boxes, 3 driving mauls, 27 $\frac{5}{8}$ " rubber washers, 105 $\frac{1}{2}$ " rubber washers, 2 new soldering irons, 105 lbs. soft solder, 25 lbs. wiping solder, 60 No. 2 round-pointed shovels—old, 60 new round-pointed shovels, 95 lbs. tin, 35 lbs. antimony, 16 lbs. zinc, 113 lbs. sheet rubber packing, 5 hose spanners, 6 pitcher pumps, 1 oil tank and pump, 45 gallons kerosene oil, 3 8" emery wheels, 2 window frames, 2 sand screens, 5 gravel screens, 1 brass dutchman, 1 iron dutchman, 12 split pins, 1 12" cog wheel, 1 8" cog wheel, 1 mortar box, 1 vise spindle, 1 sod cutter, 4 scythes, 3 snaths, 1 grass shears, 50 ft. rope for well-driving machine, 2 clamps for well-driving machine, 2 $\frac{3}{8}$ " eye bolts, 12 $\frac{3}{4}$ " corporation plugs, 1 1 $\frac{1}{2}$ " iron clamp, 200 lbs. old bolts, 10 handles for caulking hammers, 4 iron brackets, 1 templet for hydrant boxes, 1 for gate boxes, 16 post hydrants boxes, 56 lbs. rubberbestos sheet packing, 143 lbs. Jenkins sheet packing, 400 lbs. jute packing, 300 ft. felt, 6 L. W. W. stamps, 2 2" wood chisels, 1 2" auger, 3 boxes metal polish, 25 lbs. Hollingshead harness soap, 1 qt. Miller's harness dressing, 3 nickel-plated bits, 1 wheel for lawn mower, 38 lbs. annealed brass wire, 18 lbs. brass spring wire, 2 lbs. steel wire, 4 lbs. copper wire, $\frac{1}{2}$ doz. large lamp wicks, 2 balls ditch line, 6 tube cleaners, 6 wire bushes, 85 lbs. red lead, 7 lbs. babbitt, 50 Bay State incandescent lamps, 8 doz. Shelby lamps, 20 lbs. leather, 1 grub pick, 63 lbs. brass wire gauze, 3 doz. wire clamps, 8 lbs. oxalic acid, 1 30" clip, 1 24", 1 20",

1 16", 2 12", 2 10", 4 8", 5 6", 400 ft. $\frac{3}{4}$ " tin-lined iron pipe, 40 ft. 3" iron pipe, 80 ft. $\frac{1}{8}$ " round iron, 1 box Garlock packing for Ludlow hydrants, 1 Smith tapping machine, 3 drills, 3 ratchets and 3 spindles for tapping machine, 18 pipe wedges, 2 yarning irons, 2 pipe cutters, 1 Mueller tapping machine, 6 1 ft. extensions, 30 2 ft., 15 3 ft., 45 plugs for sidewalk boxes, 9 T wrenches, 7 wheelbarrows for barrow men, 5 large tool boxes, 2 small tool boxes, 3 tunneling bars, 6 crowbars, 3 derricks, 6 old wheelbarrows, 8 handles for mauls, 2 shear poles, 1 pipe-testing machine, 3 earthen sleeves for 6" pipe, 1 20" monkey wrench, 2 18", 2 14", 4 12", 6 10", 1 12", 3 36" Stillson wrenches, 1 24", 1 20", 1 16", 2 12", 2 jaws for 36" Stillson wrenches.

IRON FITTINGS.

1 6" x 2 $\frac{1}{2}$ " tee, 1 6" x 3", 1 5" x 3", 12 4" x 3", 2 4" x 2 $\frac{1}{2}$ ", 1 3" x 2 $\frac{1}{2}$ ", 5 6" x 2", 1 5" x 2", 1 4" x 2", 1 2 $\frac{1}{2}$ ", 1 4" x 1 $\frac{1}{2}$ ", 10 2", 2 2" x 1", 3 2 $\frac{1}{2}$ " x $\frac{3}{4}$ ", 2 1 $\frac{1}{2}$ ", 8 1 $\frac{1}{4}$ ", 5 1 $\frac{1}{2}$ ", 2 2" x 1", 4 1 $\frac{1}{2}$ " x $\frac{3}{4}$ ", 2 1 $\frac{1}{2}$ " x 1", 3 2" x $\frac{3}{4}$ ", 65 $\frac{3}{4}$ ", 1 3" x 2 $\frac{1}{2}$ " x 2", 2 2 $\frac{1}{2}$ " x 2" x 1 $\frac{1}{2}$ ", 1 2" x 1 $\frac{1}{2}$ " x 1", 5 2" x 1" x 1" x 1" y's; 2 2 $\frac{1}{2}$ " x 2" x 1 $\frac{1}{2}$ ", 1 2" x 1 $\frac{1}{2}$ " x 1", 2 1 $\frac{1}{2}$ " x 1", 3 2" x $\frac{3}{4}$ ", 65 $\frac{3}{4}$ "; 1 3" x 2 $\frac{1}{2}$ " x 2", 2 2 $\frac{1}{2}$ " x 2" x 1 $\frac{1}{2}$ ", 1 2" x 1 $\frac{1}{2}$ " x 1", 5 2" x 1" x 1" x 1" y's; 2 6" x 5" bushings, 2 6" x 4", 1 5" x 2 $\frac{1}{2}$ ", 3 3" x 2", 1 6" x 2", 2 5" x 2 $\frac{1}{2}$ ", 8 2" x 1 $\frac{1}{2}$ ", 2 2 $\frac{1}{2}$ " x $\frac{1}{2}$ ", 1 3" x 1 $\frac{1}{4}$ ", 1 2 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ ", 3 1 $\frac{1}{2}$ " x 1", 5 1 $\frac{1}{2}$ " x $\frac{3}{4}$ ", 3 1 $\frac{1}{2}$ " x $\frac{1}{2}$ ", 5 1 $\frac{1}{4}$ " x 1", 1 2" x $\frac{3}{4}$ ", 103 1" x $\frac{3}{4}$ ", 85 $\frac{3}{4}$ " x $\frac{1}{2}$ "; 1 hydrant bushing 5 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ ", 1 4" x 3" cross, 1 2" x 2", 7 1 $\frac{1}{2}$ " x 1", 3 1 $\frac{1}{4}$ " x 1", 4 1" x 1", 1 1" x $\frac{3}{4}$ ", 6 $\frac{3}{4}$ " x $\frac{3}{4}$ ", 3 2" x 1"; 5 6" nipples, 4 5", 6 4", 12 3", 38 2 $\frac{1}{2}$ ", 92 2", 48 1 $\frac{1}{2}$ ", 34 1 $\frac{1}{4}$ ", 220 1", 132 $\frac{3}{4}$ "; 2 3" 45° elbows, 2 2 $\frac{1}{2}$ ", 3 1 $\frac{1}{2}$ ", 29 1", 20 $\frac{3}{4}$ "; 4 2" elbows, 10 1", 20 $\frac{3}{4}$ ", 74 $\frac{3}{4}$ " x $\frac{1}{2}$ ", 35 1 $\frac{1}{4}$ ", 2 1 $\frac{1}{4}$ " x 1"; 85 2 $\frac{1}{2}$ " couplings, 72 1" x $\frac{3}{4}$ ", 88 $\frac{3}{4}$ ", 2 2 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ ", 67 1 $\frac{1}{2}$ " x $\frac{3}{4}$ ", 36 1" x $\frac{3}{4}$ ", 36 1" x $\frac{1}{2}$ ", 8 1 $\frac{1}{4}$ " x 1", 21 1 $\frac{1}{4}$ " x $\frac{3}{4}$ ", 237 2"; 4 2" x $\frac{1}{2}$ " couplings, 1 1 $\frac{1}{2}$ " x 1", 20 1 $\frac{1}{2}$ " x $\frac{3}{4}$ ", 17 1 $\frac{1}{2}$ ", 13 3", 1 8", 5 6", 3 5"; 3 4" x 10" flanges, 1 6" x 11", 4 5" x 9", 3 4" x 9", 1 4" x 11", 2 4" x 8", 1 5" x 8", 1 3" x 9", 1 7" x 1", 1 2" x 10", 2 6" x 11", 7 2", 2 1 $\frac{1}{2}$ ", 2 2", 1 6", 3 3", 3 1", 20 2 $\frac{1}{2}$ "; 1 24" $\frac{1}{4}$ curve flange, 2 6" $\frac{1}{4}$ curve flanges, 1 5" $\frac{1}{4}$ curve flange, 3 4" $\frac{1}{4}$ curve flanges; 1 1 $\frac{1}{2}$ " x 5" drop curve, 50 2 $\frac{1}{2}$ " flange curves;

12 ft. 4" iron pipe, 12 ft. 3", 85 ft. 1½", 75 ft. 1", 15 ft. ¼", 25 ft. 1¼", 50 ft. 2½"; 10 ft. ¼" x 2" Norway iron, 9 ft. ¾", 2 ft. 3", 8 ft. 1¼", 3 ft. ¾", 4 ft. 1½" x 1½"; 4 2" unions, 5 1½", 1 1¼", 15 1", 8 ¾"; 1 10" plug, 3 6", 3 5", 3 2", 10 1½", 3 1¼", 17 1", 30 ¾", 25 ½"; 36 1" corporation plugs, 7 ¾"; 1 6" cap, 1 4", 1 2", 5 1½", 4 1", 1 ¾".

One 3" Nelson valve, 13 2½" Coffin valves, 9 gallons Daggett's metal polish, 2 gallons Solshine polish, 2 gallons liquid wood filler, 24 new well heads, 1 6" cap for well head, 1 7" Worthington vacuum gauge, 1 American Gauge Co. vacuum gauge, 2 5" Ashton steam gauges, 2 2½" Ashton gauges, 1 4" water gauge, 1 old Borden 5" steam gauge, 4 2" brass elbows, 1 1", 1 2" x 1"; 2 2" brass branches, 2 1½"; 2 brass crosses, 1 1¼", 2 1½", 4 ¾"; 24½ lbs. Knowlton ring packing, 1½ lbs. Eagleline ring packing, 4 lbs. Eureka packing, 15 lbs. gasket tubing, 17½ lbs. Chesterton flat gum core packing, 4 iron hangers for bridges, 1 iron cant hook, 1 stone drag, 3 rubber suits, 32 lbs. brass wire, 20,000 ft. barbed wire, 3 new tag ropes, 350 ft. ¾" iron cable, 4 carpenter horses, 2 8 ft. wooden horses, 2 log chains, 3 slings, 814 5 ft. fence pickets, 3 double windows, 1 pipe supporter, 1 12" wooden plug, 2 8", 2 6", 1 4"; 3 buck saws, 5 hand saws, 1 long chain, 1 Gow meter testing machine, 1 doz. hand hole gaskets, 1 piston for Dean pump, 1 Howe platform scales, 150 lbs. bagging, 1 Armstrong die stock and set of dies, 60 lbs. dualin, 15 lbs. powder, 20 dippers, 6 die stocks, 57 dies, 6 ratchet die stocks, 25 bushings for die stocks, 3 cast iron pipe cutters, 4 wrought iron pipe cutters, 4 brooms, 7 chain tongs, 1 ice cutter, 2 hoes for boiler room, 4 iron crowfoots, 1 long-handle coal scoop, 1 sluice gate, 1 pipe rack, 2 marble top radiators, 2 door hangers, 6 levels, 10 ft. track for door, 2 7" pulleys for door, 1 pair skids and trucks, 1 wooden pattern for boiler front, 1 section iron ladder, 2 steel tamping bars, 3 marine pumps, 9 12 ft. lengths hose for marine pumps, 1 force pump, 12 clamps for clips.

Eight rope slings, 11 ft. 1½" common iron, 5 ft. 1¼"; 1 garden barrow, 150 ft. 5 ft. fence pickets, 150 ft. 5½ ft.; 2 9" rubber valves for condensers, 17 pipe tongs, 1 pair 6" well cleaners,

500 lbs. old rope, 6 ft. iron railing, 1 pair skids, 1 L. W. W. sign, 36 logs, 16 $1\frac{1}{4}$ " bridge bolts, 2 wagon jacks, 1 hoisting jack, 1 ditch jack, 2500 ft. 4" x 4" spruce, 7 iron fence posts, 100 ft. $\frac{3}{8}$ " rope for well driving, 2 12" pipe hangers, 2 10"; 8 lbs. plaster of Paris, 3 oil barrels, 35 lanterns, 2 barrels cylinder oil, 1 barrel engine oil, 2 $\frac{3}{4}$ " asbestos elbows, 50 ft. $\frac{3}{4}$ " rubber hose, 150 ft. old $\frac{3}{4}$ " rubber hose, 10 lengths 8" drain pipe, 1 length 6"; 30 ft. 1" steam hose, 20 lbs. leather belting, 1 lawn sprinkler, 100 lbs. old rubber hose, 4 cords wood, $\frac{1}{2}$ chaldron coke, 51 brass gate spindles, 10 spindles for independent valve for Chapman hydrants, 12 brass wrench nuts and spindles for Boston post hydrants, 8 brass cap bolts, 25 parts for Boston post hydrants, 12 spindles for Chapman hydrants, 30 hose nipples, 1 disk for 8" globe gate, 1 6", 1 4"; 6 brass parts for Ludlow hydrants, 20 assorted brass spindles for hydrants, 6 caps for Boston post hydrants, 100 caps for hydrant nipples, 20 rubber valves for hydrants, 32 rubber gaskets for gates, 100 hydrant gaskets, 8 4" leather valves, 6 5".

Twenty-six 1" iron gate wrench nuts, 10 iron plates for dog troughs, 1 cap for Chapman hydrant, 3 plates for bottom of fountains, 1 30" bottom for fountain, 3 backs for fountains, 20 bottom parts for post hydrants, 1 barrel for 6" Chapman hydrant, 1 barrel for 5" Chapman hydrant, 6 goose necks for fountains, 50 lbs. bolts for hydrants and gates, 15 lbs. sheet lead, 17 drills and 3 taps, 1 S wrench, 4 chisels, 1 bit stock, 10 ft. chain for fountains, 1 dry tapping machine, 1 reamer, 1 level, 2 lanterns, 6 bolts and plates for hydrants, 1 brass dutchman, 1 4" stand-pipe, 1 marlin spike, 1 tool box and set of tools for hydrants and gates, 1 bench and vise, 2 desks, 1 dipper and tunnel for thawing out hydrants, 1 Lowrey hydrant wrench, 3 parts of hydrant tester.

BRASS STOCK.

One 1" x $1\frac{1}{4}$ " Hancock inspirator, 17 castings for $\frac{3}{4}$ " nipples, 12 5" seats for high duty engine, 1 gland for high duty engine, 8 swivel valves, 2 plunger heads $4\frac{1}{2}$ " x 4", 37 studs for valve plates, 120 valve plates, 5 faucets for drinking fountains, 4

castings for hose connections, 86 half union nuts, 93 castings for 1" unions, 125 1" solder nipples, 42 $\frac{1}{2}$ " elbows, 33 $\frac{1}{2}$ " x $\frac{1}{2}$ " elbows, 35 $\frac{1}{2}$ " unions, 62 $\frac{1}{2}$ " nuts, 12 studs for marine pump, 12 pet cocks, 7 gauge cocks, 3 2" Mueller corporation cocks, 4 $1\frac{1}{2}$ "; 8 2" Mueller sidewalk cocks, 5 $1\frac{1}{2}$ ", 19 $\frac{1}{2}$ "; 13 1" corporation cocks, 115 $\frac{1}{2}$ "; 5 1" sidewalk cocks, 85 $\frac{1}{2}$ "; 4 1" cellar cocks, 53 $\frac{1}{2}$ "; 49 1" solder nipples, 18 $\frac{1}{2}$ ", 6 $1\frac{1}{2}$ ", 6 $1\frac{1}{2}$ "; 38 lbs. brass wire.

LEAD-LINED FITTINGS.

194 $\frac{1}{2}$ " elbows, 28 1" x $\frac{1}{2}$ ", 32 1", 93 $\frac{1}{2}$ " x $\frac{1}{2}$ ", 3 1", 4 $1\frac{1}{2}$ " x 1", 2 $1\frac{1}{2}$ "; 75 $\frac{1}{2}$ " tees, 3 1"; 83 $\frac{1}{2}$ " couplings, 8 2" x 1" crosses, 4 $1\frac{1}{2}$ " x $\frac{1}{2}$ "; 6 2" x $\frac{1}{2}$ " tees, 4 2", 1 $1\frac{1}{2}$ " x $\frac{1}{2}$ "; 14 2" elbows, 13 $1\frac{1}{2}$ "; 130 lbs. 1" old lead pipe, 55 lbs. $\frac{1}{2}$ ", 225 lbs. $\frac{3}{8}$ ".

PATTERNS.

One cylinder for Morris engine, 1 grate for boilers, 1 hydrant box, 1 gate box, 1 section for grates, 1 apron for drinking fountain, 1 set packing glands for pumps, 1 set grates for boilers at the Boulevard station, 1 set improved cellar cocks, 2 $\frac{1}{2}$ " hose connections, 1 1"; 1 hydrant spindle, 1 cap for standpipe in drinking fountain, 1 plumb bob, 1 goose neck for fountains, 1 foot valve for high duty engine, 1 set for 1" sidewalk cocks, 1 set for 2" plugs, 1 wood and 2 brass patterns for cellar cocks, 2 wood patterns for heads for pumps, 1 wood pattern for 8" machine wrench, 1 trap door, 1 packing box for pumps, 1 gland for high service engine, 2 plunger rods for pumps, 3 slide valves for Morris engine, 1 set of bushings, 4 sizes, 1 set for high duty engine, 1 gate of patterns for $\frac{3}{4}$ " sidewalk cocks, 1 gate of 4" brass patterns for $\frac{3}{4}$ " plugs for sidewalk cocks, 1 gate 4" brass patterns for $\frac{3}{4}$ " cellar cocks, 1 gate 4" brass patterns for $\frac{1}{2}$ " tail pieces, 1 gate 4" brass patterns for $\frac{3}{4}$ " nuts, 1 gate 4" brass patterns for $\frac{3}{4}$ " washers, 1 gate 4" brass patterns for 1" x $\frac{1}{2}$ " couplings, 1 gate 4" brass patterns for $\frac{3}{4}$ " thimbles, 1 pattern for 6" strainer, 2 patterns for rings for high service engine, 1 set patterns for brass railing.

Two 6" Tilton automatic gates with 2 3" Hersey meters, 1 6" Gem meter, 1 6" Crest meter, 1 6" Torrent meter, 5 1" Crown meters, 1 $\frac{5}{8}$ " Lambert meter, 6 $\frac{3}{4}$ " Crown meters, 1 3" Worthington meter, 7 $\frac{5}{8}$ " Crown meters, 1 1" Worthington meter, 6 $\frac{3}{4}$ " Empire meters, 1 $\frac{3}{4}$ " Worthington meter, 3 $\frac{5}{8}$ " Empire meter, 2 $\frac{5}{8}$ " Worthington meters, 1 $\frac{5}{8}$ " Nash meter, 2 $\frac{3}{4}$ " Columbia meters, 3 $\frac{3}{4}$ " Union meters, 2 $\frac{5}{8}$ " Columbia meters, 3 $\frac{5}{8}$ " Union meters, 25 pairs of couplings for $\frac{5}{8}$ " meters, 20 pairs of couplings for $\frac{3}{4}$ " meters, 5 pairs of couplings for 1" meters, 2 covers for old style 1" Crown meters, 5 covers for A. style 1" Crown meters, 3 covers for A.A. style 1" Crown meters, 3 covers for old style $\frac{3}{4}$ " Crown meters, 10 covers for A. style $\frac{3}{4}$ " Crown meters, 6 covers for A.A. style $\frac{3}{4}$ " Crown meters, 20 covers for old style $\frac{5}{8}$ " Crown meters, 4 covers for A. style $\frac{5}{8}$ " Crown meters, 11 covers for A.A. style $\frac{5}{8}$ " Crown meters, 1 cover for $\frac{3}{4}$ " Nash meter, 1 $\frac{5}{8}$ "; 5 bottoms for $\frac{5}{8}$ " Nash meters, 5 bottoms for $\frac{5}{8}$ " Empire meters, 2 for $\frac{3}{4}$ "; 5 bottoms for $\frac{5}{8}$ " Trident meters, 4 bottoms for $\frac{3}{4}$ " Trident meters.

One gear train for old style $\frac{3}{4}$ " Crown meter, 7 gear trains for old style $\frac{5}{8}$ " Crown meters, 11 gears train for A. style $\frac{3}{4}$ " Crown meters, 17 gear trains for A. style $\frac{5}{8}$ " Crown meters, 2 gear trains for A. style 1" Crown meters, 27 gear trains for Trident meters, 28 gear trains for Hersey meters, 25 dials for Crown meters, 11 dials for Nash meters, 9 dials for Trident meters, 1 counter for $\frac{5}{8}$ " Empire meter, 13 counters for Worthington meters, 6 ratchets for Worthington meters, 16 clock covers for Worthington meters.

TOOLS IN TEAMS.

Four picks, 5 shovels, 5 gate wrenches, 4 T wrenches, 4 fork wrenches, 5 square head wrenches, 8 Stillson wrenches, 6 monkey wrenches, 3 screw-drivers, 1 post hydrant wrench, 1 flush hydrant wrench, 2 crowbars, 3 lanterns, 1 Armstrong die stock, 1 Star die stock, 2 $\frac{3}{4}$ " dies, 1 1" die, 1 pipe cutter, 2 1" plugs, 1 50 ft. tape line.

MOVABLE FIXTURES AND PROPERTY AT OFFICE,
CITY HALL.

Two roll-top desks, 2 standing desks, 1 double flat desk, 1 3-place inspector's desk, 1 2-place inspector's desk, 1 single inspector's desk, 2 heavy oak tables, 1 typewriter desk, 1 Remington typewriter, 1 small table, 1 vault table, 2 swivel upholstered chairs, 6 upholstered chairs, 12 cane-seated armchairs, 8 swivel cane-seated chairs, 2 high chairs, 2 stools, 1 step chair, 1 settee, 1 bookcase, 2 water-pressure gauges, 1 thermometer, 1 clock, 2 table gas lamps, 33 framed pictures—plans, etc.; 2 2 floor rugs, 1 set street tools, 2 earthen spittoons, 6 brass spittoons, 6 waste paper baskets, 1 shovel (historic), 2 mirrors, 1 letter copying press, 2 umbrella racks, 20 inkstands, 2 pen racks, 4 book racks, set tools (hammer, wrench, 2 screw-drivers, wire cutter, 1 plane, 1 saw, 1 chisel), 3 tumblers, boot-blackening outfit, 1 hair brush, 1 clothes brush, 1 match chest, 1 fire-insurance map of Lowell, 1 atlas city of Lowell, 5 tin yearly boxes, 1 set Massachusetts statutes, 1 large dictionary, 1 large photo. album, 1 revolving bookcase, 1 card index case, 1 meter card cabinet on wheels.



WEST SIXTH STREET PUMPING STATION, BOILER HOUSE AND WORK SHOP.

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Report of the City Engineer.

OFFICE OF CITY ENGINEER.

LOWELL, MASS., January 1, 1904.

To the Lowell Water Board.

GENTLEMEN:—I have the honor to submit the Thirty-first Annual Report, for the year ending December 31st, 1903.

PUMPAGE.

Total net pumpage for 1903.....	1,923,370,860 Gals.
Total net pumpage for 1902.....	2,090,924,110 Gals.
A decrease in 1903 of	167,553,250 Gals.

CONSUMPTION.

Consumption for 1903.....	1,922,390,231 Gals.
Consumption for 1902.....	2,091,203,586 Gals.
A decrease in 1903 of	168,813,355 Gals.

The greatest quantity pumped in one day was 7,923,750 gallons, on January 26th.

The greatest quantity pumped in one week was 49,701,875 gallons, January 22nd to January 28th.

The pumpage for High Service was 52,873,758 gallons, which is 199,864 gallons more than that of last year.

The cost of Low Service pumpage has been twenty-four dollars and three cents (\$24.03) per million gallons, an increase of five dollars and nineteen cents (\$5.19) per million gallons above that of last year.

The cost of High Service pumpage has been forty dollars and thirty-one cents (\$40.31) per million gallons, an increase of seven dollars and thirty-two cents (\$7.32) per million gallons above that of last year.

TABLE SHOWING QUANTITY PUMPED EACH MONTH AT THE SEVERAL STATIONS
DURING THE YEAR 1903.

Months	PUMPING STATIONS										Grand Totals	Net Totals
	Driven Wells		West Sixth Street					Totals Low Service	High Service			
	Lower Boulevard	Upper Boulevard	Net Totals	Worthington High Duty	Worth'gt'n Duplex	Morris						
Jan.	241,982,590	.....	241,982,590	191,409,375	.....	.....	191,409,375	2,516,976	435,908,941	191,409,375	
Feb.	176,445,970	.....	176,445,970	170,332,125	321,780	.....	170,653,905	1,810,746	348,910,621	170,653,905	
March	173,598,006	.....	173,598,006	26,998,500	8,793,460	123,061,760	158,853,720	2,449,706	334,901,432	158,853,720	
April	165,905,890	.....	165,905,890	92,868,750	.....	61,271,360	154,140,110	2,575,818	322,621,818	154,140,110	
May	175,008,298	.....	175,008,298	123,975,000	.....	47,660,480	171,635,480	3,503,612	350,147,390	171,635,480	
June	88,067,844	63,203,034	151,270,878	133,111,875	22,590,320	.....	155,702,195	3,244,654	310,217,727	155,702,195	
July	74,149,258	105,725,048	179,874,306	170,506,875	.....	.....	170,506,875	6,274,786	356,655,967	170,506,875	
Aug.	149,003,958	3,296,240	152,300,198	157,676,250	.....	.....	157,676,250	8,448,104	318,424,552	157,676,250	
Sept.	139,345,478	10,794,728	150,140,206	28,601,250	.....	119,054,720	147,655,970	8,550,108	306,346,284	147,655,970	
Oct. ....	.....	144,995,312	144,995,312	131,208,750	.....	16,336,320	147,545,070	8,241,352	300,781,734	147,545,070	
Nov.	61,730,440	78,767,364	140,497,804	129,781,875	9,179,410	.....	138,961,285	2,658,306	282,117,395	138,961,285	
Dec.	148,016,724	.....	148,016,724	158,630,625	.....	.....	158,630,625	2,599,590	309,246,939	158,630,625	
Totals	1,593,254,456	406,781,726	2,000,036,182	1,515,101,250	40,884,970	367,384,640	1,923,370,890	52,873,758	3,976,280,800	1,923,370,890		

TABLE SHOWING SOURCE OF SUPPLY, QUANTITY PUMPED AND COST OF PUMPING
AT THE SEVERAL STATIONS DURING THE YEAR 1903.

PUMPING STATIONS	SOURCE OF SUPPLY—WELL WATER.					COST		
	345 Driven Wells at Paw- tucket Boulevard	90 Driven Wells at City Farm	120 Driven Wells in Chelms- ford, Mass.	Distributing Mains of Low Service System	Totals in U. S. Alabama	Totals	Per Million Gallons	
West Sixth Street Low Service	1,923,370,800				1,923,370,800	\$20,431.06	\$10.02+	
High Service				52,873,758	52,873,758	861.03	16.28+	
Cook Wells		No Pumpage						
Lower Boulevard	1,593,254,456				1,593,254,456	22,107.91	13.88—	
Upper Boulevard	406,781,726				406,781,726	3,678.40	9.04+	
Total Pumpage					3,976,280,800	\$47,070.00	\$11.84+	
Deduct { at Lower Boulevard quantity { at Upper Boulevard pumped { by High Service	1,593,254,456*			52,873,758	2,052,908,940			
Net Pumpage					1,923,370,800	\$47,070.00	\$24.48—	
Cost exclusive of High Service							24.03—	
Total cost of High Service pumpage							\$40.31	

*Repumped at West Sixth Street.

The following tables, showing the performance of the engines, depth and quantity of water in the Beacon Street Reservoir, average temperature of the air and water at the Beacon Street Reservoir, and the average monthly and daily consumption of water, have been calculated from the records of the engineers and gatekeeper.

TABLE SHOWING WORK DONE WITH MORRIS ENGINE (BEAM AND FLY WHEEL) FOR
EACH MONTH DURING THE YEAR 1903.

MONTHS	No. of days pump'g	Average No. of hours pump'g per day	No. of hours pump'g per month	No. of stroke made per month	Average No. of strokes made per minute	Average head, including friction, in feet	Quantity pumped per month in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gals. of water pumped into reservoir per lb. total coal consumed	Duty in lbs. with 100 lbs. coal used in pump'g only, no deduction for ashes or clinkers	Duty on total coal consumed, no deduction for ashes or clinkers
January											
February											
March	25	23-11	579-30	384,568	11.06	164.19	123,061,760	4,922,470	400	63,613,559	62,985,406
April	15	21-00	315-00	191,473	10.13	164.32	61,271,360	4,084,757	400	63,015,478	63,015,478
May	13	19-25	252-30	148,939	9.83	163.95	47,660,480	3,666,191	505	72,308,836	68,940,651
June											
July											
August											
September	27	21-56	592-00	372,046	10.47	163.42	119,054,720	4,409,434	550	74,973,707	74,973,707
October	5	17-48	89-00	51,051	9.56	164.45	16,336,320	3,267,264	493	67,306,953	67,306,953
November											
December											
Totals and Averages	85	21-30	1,828-00	1,148,077	10.47	163.95	367,384,640	4,322,172	494	68,977,734	67,433,906

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH SERVICE ENGINE
FOR EACH MONTH DURING THE YEAR 1903.

MONTHS	No. of days pumping	Average No. of hours pumping per day	No. of hours pumping per month	No. of strokes made per month	Average No. of strokes made per minute	Average head, including friction, in feet	Quantity pumped per month in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gals. pumped into reservoir per lb. total coal consumed	Coal in lbs. used when pumping
January . . .	10	14-51	148-30	179,784	20.18	70.44	2,516,976	251,698	300	8,390
February . .	6	17-40	106-00	129,339	20.34	70.44	1,810,746	301,791	300	6,036
March	8	16-22	131-00	174,979	22.26	70.44	2,449,706	306,213	300	8,166
April	8	18-26	147-30	183,987	20.79	70.44	2,575,818	321,977	300	8,586
May	11	18-11	200-00	250,258	20.85	70.44	3,503,612	318,510	300	11,679
June	13	16-53	219-30	231,761	17.60	70.44	3,244,654	249,589	300	10,815
July	23	23-29	540-00	448,199	13.83	89.56	6,274,786	272,817	300	20,916
August	31	24-00	744-00	603,436	13.52	93.59	8,448,104	272,519	300	28,160
September . .	30	24-00	720-00	610,722	14.14	93.59	8,550,108	285,004	300	28,500
October	29	23-48	690-00	588,668	14.22	91.99	8,241,352	284,185	300	27,471
November . . .	8	18-15	146-00	189,879	21.68	70.44	2,658,306	332,288	300	8,861
December . . .	8	17-07	137-00	185,685	22.59	70.44	2,599,590	324,949	300	8,665
Totals and Averages	185	21-14	3,929-30	3,776,697	16.02	83.83	52,873,758	285,804	300	176,245

TABLE SHOWING AMOUNT OF COAL USED FOR WOR-
THINGTON HIGH DUTY ENGINE AT PUMPING
STATION DURING THE YEAR 1903.

MONTHS	COAL CONSUMED.			
	For Starting Fires, In Pounds	When Pump- ing, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January	600	364,344	600	365,544
February .....	.....	332,016	.....	332,016
March .....	.....	52,579	.....	52,579
April .....	.....	164,113	.....	164,113
May	6,110	177,956	1,000	185,066
June	2,100	187,968	.....	190,068
July	600	237,374	600	238,574
August .....	.....	238,467	.....	238,467
September	2,405	41,787	.....	44,192
October .....	.....	213,648	.....	213,648
November	3,920	215,579	1,600	221,099
December	900	271,968	900	273,768
Totals	16,635	2,497,799	4,700	2,519,134

TABLE SHOWING AMOUNT OF COAL USED FOR WOR-
THINGTON DUPLEX ENGINE AT PUMPING
STATION DURING THE YEAR 1903.

MONTHS	COAL CONSUMED.			
	For Starting Fires, In Pounds	When pump- ing, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January
February	1,070	.....	1,070
March	27,712	.....	27,712
April
May
June	63,009	.....	63,009
July
August
September
October
November.....	27,110	.....	27,110
December
Totals	118,901	.....	118,901

TABLE SHOWING AMOUNT OF COAL USED FOR MORRIS
ENGINE AT PUMPING STATION DURING THE YEAR 1903.

MONTHS	COAL CONSUMED.			
	For Starting Fires, In Pounds	When Pump- ing, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January .....	.....	.....	.....	.....
February .....	.....	.....	.....	.....
March	2,640	264,712	.....	267,352
April .....	.....	133,154	.....	133,154
May	2,200	90,060	2,200	94,460
June .....	.....	.....	.....	.....
July .....	.....	.....	.....	.....
August .....	.....	.....	.....	.....
September .....	.....	216,270	.....	216,270
October .....	.....	33,166	.....	33,166
November .....	.....	.....	.....	.....
December .....	.....	.....	.....	.....
Totals	4,840	737,362	2,200	744,402

TABLE SHOWING AMOUNT OF COAL USED FOR
KNOWLES ENGINES AT PUMPING STATION,
LOWER BOULEVARD, DURING THE YEAR 1903.

MONTHS	COAL CONSUMED.			
	For Starting Fires, In Pounds	When Pump- ing, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January	651,830	.....	651,380
February	488,400	.....	488,400
March	442,658	.....	442,658
April	402,803	.....	402,803
May	555,205	.....	555,205
June	228,280	.....	228,280
July	198,275	.....	198,275
August	381,720	.....	381,720
September	348,139	.....	348,139
October
November	150,140	.....	150,140
December	331,740	.....	331,740
Totals	4,179,190	.....	4,179,190

TABLE SHOWING AMOUNT OF COAL USED FOR WOR-
THINGTON ENGINES AT PUMPING STATION, UPPER
BOULEVARD, DURING THE YEAR 1903.

MONTHS	COAL CONSUMED.			
	For Starting Fires, In Pounds	When Pump- ing, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January
February
March
April
May
June	109,634	.....	109,634
July	206,435	.....	206,435
August	4,770	.....	4,770
September	22,535	.....	22,535
October	261,600	.....	261,600
November	136,558	.....	136,558
December
Totals	741,532	.....	741,532

WEST SIXTH STREET PUMPING STATION, WOR-
THINGTON HIGH DUTY ENGINE, RUNNING
EXPENSES FOR THE YEAR 1903.

Pay of Engineers and Firemen	\$6,465.94
1,259 1134-2000 tons of bituminous coal, at \$6.672—	8,403.83
Gas for lighting works	3.33
365 75-100 gallons of cylinder oil, at \$0.4146—	151.63
137 83-100 gallons of engine oil, at \$0.3475	47.89
152 75-100 pounds of packing, at \$0.762—	116.39
299 53-100 pounds of cotton waste, at \$0.092+	27.56
10 pounds of tallow at \$0.05 .....	.50
Repairs on engine	231.21
Repairs on boilers	47.07
Tools and stock	21.01
Sundries	128.44
Total	\$15,644.80

Cost of pumping water into reservoir per million gallons, \$10.33—.

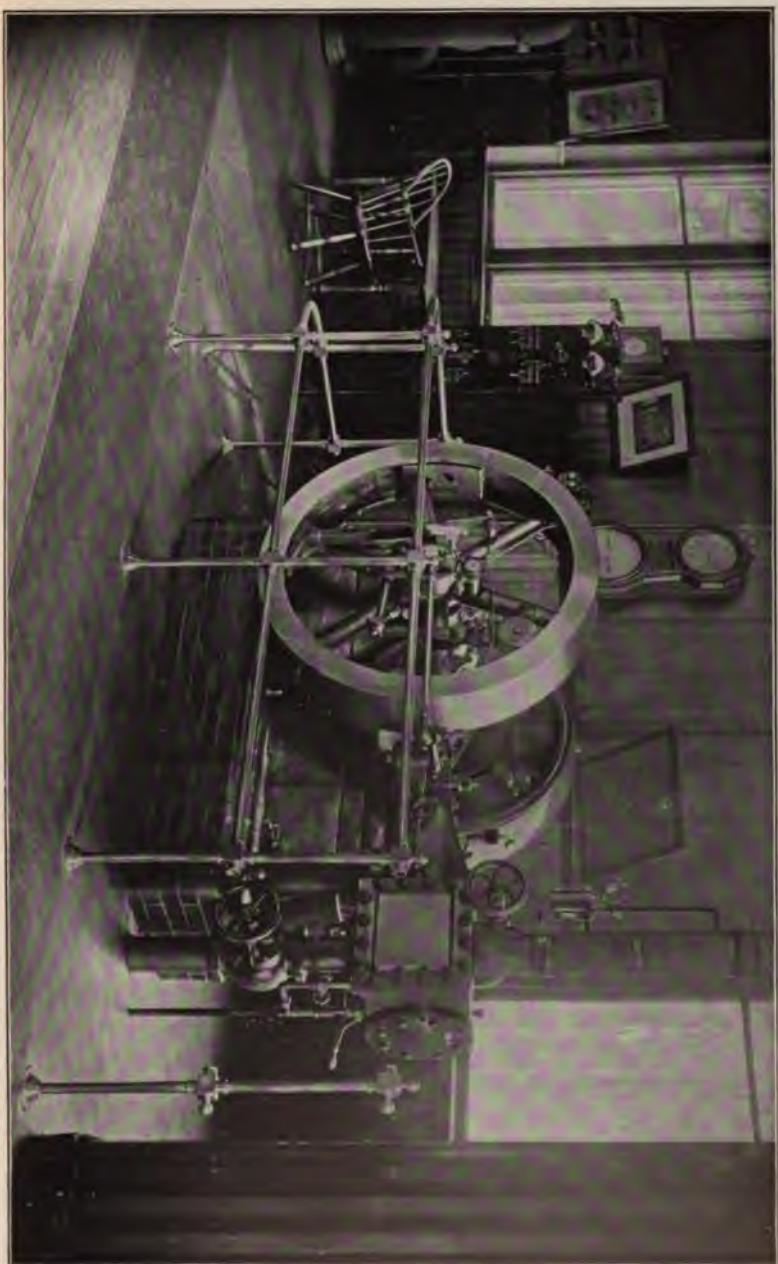
Cost of pumping water one foot high per million gallons, .06 29-100—.

WEST SIXTH STREET PUMPING STATION,
 WORTHINGTON DUPLEX ENGINE,
 RUNNING EXPENSES FOR THE YEAR 1903.

Pay of Engineers and Firemen.....	\$167.94
59 901-2000 tons of bituminous coal, at \$6.672—	396.65
9 50-100 gallons of cylinder oil, at \$0.4146+	3.94
3 58-100 gallons of engine oil, at \$0.3475	1.24
5 pounds of packing, at \$0.762—.....	3.81
7 78-100 pounds of cotton waste, at \$0.092—.....	.71
6 26-100 pounds of tallow, at \$0.05.....	.31
Repairs on boilers.....	1.22
Tools and stock.....	.55
Sundries	2.37
Total	\$578.74

Cost of pumping water into reservoir per million gallons, \$14.16.

Cost of pumping water one foot high per million gallons, .08 66-100—



AMES ENGINE AND DYNAMO AT WEST SIXTH STREET PUMPING STATION.

1000

**WEST SIXTH STREET PUMPING STATION,
MORRIS ENGINE.
RUNNING EXPENSES FOR THE YEAR 1903.**

Pay of Engineers and Firemen.....	\$1,511.32
372 402-2000 tons of bituminous coal, at \$6.672—.....	2,488.82
85 50-100 gallons of cylinder oil, at \$0.4146—.....	35.44
32 22-100 gallons of engine oil, at \$0.3475.....	11.20
15 pounds of packing, at \$0.223—.....	3.34
70 2-100 pounds of cotton waste, at \$0.092—.....	6.44
9 34-100 pounds of tallow, at \$0.05.....	.47
Repairs on engine.....	110.15
Repairs on boilers.....	11.00
Tools and stock.....	4.01
Sundries	21.83
Total	\$4,208.12

Cost of pumping water into reservoir per million gallons, \$11.45+

Cost of pumping water one foot high per million gallons, .00 00-100 .

WEST SIXTH STREET PUMPING STATION,
HIGH SERVICE ENGINE,
RUNNING EXPENSES FOR THE YEAR 1903.

Pay of Engineers and Firemen.....	\$251.92
88 245-2000 tons of bituminous coal, at \$6.372—.....	587.95
14 25-100 gallons of cylinder oil, at \$0.4146—.....	5.91
5 37-100 gallons of engine oil, at \$0.3475.....	1.87
8 pounds of packing, at \$0.7624.....	6.10
11 67-100 pounds of cotton waste, at \$0.092—.....	1.07
Repairs on boilers.....	1.84
Tools and stock.....	.82
Sundries.....	3.55
Total.....	\$861.03

Cost of pumping water into reservoir per million gallons, \$16.28+.

Cost of pumping water one foot high per million gallons, .19 43-100—.

LOWER BOULEVARD PUMPING STATION,
KNOWLES ENGINES,
RUNNING EXPENSES FOR THE YEAR 1903.

Pay of Engineers and Firemen.....	\$ 5,293.21
2,089 1190-2000 tons of bituminous coal, at \$7.646+	15,977.09
125 gallons of kerosene oil for lighting works, at \$0.124.....	15.50
211 gallons of cylinder oil, at \$0.413—.....	87.09
40 gallons of engine oil, at \$0.35.....	14.00
1 gallon lard oil, at \$0.65 .....	.65
34 5-10 pounds of packing, at \$0.969.....	33.44
155 pounds of cotton waste, at \$0.092—.....	14.18
Repairs on engine.....	187.14
Repairs on boilers.....	331.27
Tools and stock.....	34.80
Sundries	110.54
Total	\$22,107.01

Cost of pumping water into conduit per million gallons, \$13.88—.

UPPER BOULEVARD PUMPING STATION,
WORTHINGTON ENGINES,
RUNNING EXPENSES FOR THE YEAR 1903.

Pay of Engineers and Firemen.....	\$1,581.09
370 1532-2000 tons of bituminous coal, at \$5.105+	1,892.80
125 gallons of kerosene oil for lighting works, at \$0.124	15.50
54 gallons of cylinder oil, at \$0.44	23.76
10 gallons of engine oil, at \$0.35	3.50
15 pounds of packing, at \$0.969	14.53
75 pounds of cotton waste, at \$0.092—	6.90
Repairs on boilers.....	84.97
Tools and stock.....	15.60
Sundries	39.84
Total	\$3,678.49

Cost of pumping water into conduit per million gallons, \$9.04+.

RESERVOIR, BEACON STREET, 1903.

MONTHS	Depth in feet	Quantity in U. S. Gallons	Temperature in Degrees	
			Of Water	Of Air
January	19.36	29,441,050	45.56	27.04
February	19.83	30,220,432	45.52	29.81
March	20.05	30,607,544	39.47	42.20
April	19.78	30,145,961	39.03	48.42
May	19.19	29,156,175	41.31	61.00
June	19.80	30,181,089	45.82	61.09
July	19.43	29,561,314	52.08	72.49
August	19.98	30,487,776	56.89	65.32
September	20.41	31,210,714	57.88	64.87
October	19.82	30,207,786	57.60	51.87
November	20.01	30,535,667	55.93	38.00
December	20.05	30,600,497	51.21	27.25

TABLE SHOWING THE AVERAGE MONTHLY AND
DAILY CONSUMPTION OF WATER FOR THE
YEAR 1903.

MONTHS	Gallons per Month	Gallons per Day
January	190,989,950	6,160,966
February	169,529,240	6,054,616
March	158,571,141	5,115,198
April	154,422,689	5,147,423
May	173,039,902	5,581,932
June	153,732,050	5,124,402
July	172,477,020	5,563,775
August	155,564,454	5,018,208
September	148,080,765	4,936,025
October	149,092,263	4,809,428
November	138,400,644	4,613,355
December	158,490,113	5,112,584
Totals and Averages	1,922,390,231	5,266,823

SUMMARY OF STATISTICS.

FOR THE YEAR ENDING DECEMBER 31st, 1903.

In form recommended by the New England Water Works Association.

LOWELL WATER WORKS.

LOWELL, MIDDLESEX COUNTY, MASSACHUSETTS.

GENERAL STATISTICS.

Population by census of 1900, 94,969.

Date of construction, 1870 to 1873.

Date of construction High Service, 1881.

Date of construction Driven Wells, 1893 to 1903.

By whom owned: The City of Lowell.

Source of supply: Two hundred ten (210) driven wells in the valley of River Meadow Brook (not used in 1903), and three hundred forty-five (345) driven wells at Pawtucket Boulevard.

Mode of supply: Pumping to reservoir and pumping direct.

PUMPING STATISTICS.

1. Builders of Pumping Machinery.

AT WEST SIXTH STREET STATION.

One engine, capacity 5,000,000 gallons in 24 hours, Henry G. Morris.

One engine, capacity 5,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 10,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 500,000 gallons in 24 hours, Henry R. Worthington.

AT COOK WELLS STATION—TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, The Deane Steam Pump Co.

One engine, capacity 3,000,000 gallons in 24 hours, The Deane Steam Pump Co.

AT LOWER BOULEVARD STATION—TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

AT UPPER BOULEVARD STATION—TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

2. Description of fuel used: —a. Kind, bituminous.
 b. Brand of coal.
 c. Average price of coal per gross ton, delivered, \$7.86—
 d. Percentage of ash.
 e. Wood, price per cord,
3. Coal consumed for the year, 8,479,404 pounds.
 (Low Service, West Sixth Street Station, 3,382,437 pounds).
4. (Pounds of wood) ÷ 3 = equivalent amount of coal = 2,400.
 West Sixth Street Station.
5. Total equivalent coal consumed for the year = (3) + (4),
 8,481,804 lbs. (Low Service, West Sixth Street Station,
 3,384,837 lbs.)

6. Total pumpage for the year, 1,923,370,860 gallons.
7. Average static head against which pumps work, 156.57 feet, West Sixth Street Station.
8. Average dynamic head against which pumps work, 164.15 feet, West Sixth Street Station.
9. Number of gallons pumped per pound of equivalent coal (5), 227. (Low Service, West Sixth Street Station, 568.)
10. Duty =
$$\frac{\text{Gals. pumped (6)} \times 8.34 (\text{lbs.}) \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}}$$

= 77,791,512. West Sixth Street Station.
Cost of pumping figured on pumping station expenses, viz.: \$46,218.06.
11. Per million gallons pumped, \$24.03— Low Service.
12. Per million gallons raised one foot (dynamic), \$0.1464— Low Service.

The State Board of Health has made analyses of water each month from the Merrimack River (for record only), wells at Pawtucket Boulevard and West Sixth Street Pumping Station, a record of which is annexed, together with a statement of the typhoid epidemic taken from the records of the Board of Health.

On July 18th, after a fire in the works of the Merrimack Manufacturing Company, the check valve which acts between the Merrimack River water (used by the manufacturing companies for fire purposes and owned and controlled by them) and the city water, failed to operate, with the result that a large quantity of river water was pumped into the city mains through this open valve. In about three weeks a large number of cases of typhoid fever were reported, followed by a serious epidemic. The following table shows the number of cases of typhoid fever and deaths from the same during the months of August and September for the last three years.

Respectfully submitted.

GEORGE BOWERS,

City Engineer.

331046

WEEKLY REPORT OF CASES REPORTED AND DEATHS FROM "TYPHOID."

1901 Week Ending	Cases Reported	Deaths	1902 Week Ending	Cases Reported	Deaths	1903 Week Ending	Cases Reported	Deaths
August 3	0	0	August 2	2	0	August 1	0	1
August 10	1	0	August 9	1	1	August 8	0	0
August 17	0	0	August 16	0	1	August 15	13	0
August 24	1	0	August 23	2	0	August 22	75	1
August 31	4	0	August 30	0	1	August 29	41	1
September 7	3	0	September 6	4	2	September 5	20	2
September 14	1	1	September 13	1	0	September 12	7	2
September 21	1	0	September 20	2	0	September 19	8	2
September 28	2	0	September 27	3	1	September 26	4	0
Totals	13	1		15	6		108	9

**COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS. Merrimac River. (Parts in 100,000.)**

No.	Date of		Appearance.		Odor.		Residue on Evaporation.		Ammonia.			Chlorine.		Nitrogen as		Hardness	Iron.	Oxygen Consumed	
	Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on Ignition.	Fixed.	Free.	Total.	In Solution.	In Suspension.	Nitrates.				Nitrites.
43,954	Jan., 1903	27	v. slight	v. slight	.31	faintly vegetable	faintly vegetable	3.20	1.30	1.90	.0036	.0116	.0100	.0016	.14	.0030	.0001	0.8	.53
44,321	Feb. 25	25	slight	v. slight	.22	v. faintly unpleasant	v. faintly unpleasant	2.80	1.05	1.75	.0034	.0120	.0034	.0026	.17	.0080	.0001	1.0	.39
44,703	March 24	25	decided	cons.	.32	faintly unpleasant	faintly unpleasant	2.80	1.15	1.65	.0006	.0134	.0106	.0028	.10	.0060	.0001	0.6	.49
45,122	April 28	29	v. slight	slight	.22	faintly unpleasant	faintly unpleasant	3.00	1.15	1.85	.0014	.0122	.0104	.0018	.15	.0070	.0000	0.5	.39
45,528	May 26	27	slight	cons	.20	faintly vegetable	distinctly vegetable	3.50	1.35	2.15	.0036	.0154	.0118	.0036	.19	.0060	.0002	1.0	.48
45,920	June 22	23	decided	cons.	.60	faintly vegetable	faintly vegetable	3.85	2.05	1.80	.0056	.0192	.0144	.0048	.10	.0010	.0001	0.6	.82
46,386	July 21	22	slight	cons.	.23	faintly vegetable	distinctly vegetable	3.30	1.35	1.95	.0042	.0148	.0108	.0040	.21	.0050	.0001	1.1	.48
46,839	Aug. 18	19	slight	slight	.24	faintly vegetable	faintly vegetable	3.90	1.80	2.10	.0068	.0150	.0118	.0032	.18	.0020	.0001	1.3	.62
47,174	Sept. 15	15	slight	cons.	.29	distinctly vegetable	distinctly vegetable	3.80	1.30	2.50	.0046	.0166	.0118	.0048	.23	.0060	.0002	0.8	.44
47,688	Oct. 20	21	v. slight	slight	.52	faintly vegetable	faintly vegetable	4.60	1.70	2.90	.0072	.0200	.0172	.0028	.32	.0050	.0001	1.1	.85*
48,093	Nov. 16	17	slight	cons.	.26	faintly vegetable	faintly vegetable	4.15	1.35	2.80	.0062	.0154	.0120	.0034	.28	.0050	.0005	1.3	.64*
48,474	Dec. 22	23	decided	cons.	.35	faintly unpleasant	faintly unpleasant	4.45	1.70	2.75	.0072	.0236	.0182	.0054	.27	.0060	.0004	1.3	.72*

* Above dam.

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Boulevard Wells. (Parts in 100,000.)

No	Date of		Appearance.		Odor.		Residue on Evaporation.			Ammonia.				Chlorine.	Nitrogen as		Hardness.	Iron.	Oxygen Consumed.
	Collection.	Examination.	Turbidity.	Sediment.	Color.	Cold.	Hot.	Total.	Loss on Ignition.	Fixed.	Free.				In Solution.	Albuminoid.			
											Total.	In Solution.	Nitrates.							Nitrites.
43,955	Jan., 1903 27	v. slight	slight		.06	none	none	4.70			.0074	.0058		.22	.0330	.0001	1.6	.0500	.10*
44,322	Feb. 25	none	v. slight		.00	none	none	3.60			.0064	.0024		.25	.0280	.0000	1.7	.0700	.10*
44,704	March 25	none	v. slight		.04	none	none	3.70			.0042	.0020		.18	.0170	.0000	1.3	.0400	.06*
45,123	April 23	v. slight	slight		.06	none	none	4.00			.0050	.0020		.24	.0360	.0000	1.4	.0510	.04*
45,530	May 27	v. slight	none		.00	none	none	3.20			.0026	.0022		.25	.0510	.0000	1.8	.0090	.05*
45,921	June 22	none	none		.00	none	none	3.50			.0000	.0012		.20	.0170	.0001	1.3	.0010	.03†
46,387	July 21	none	none		.01	none	v. faintly unpleasant	3.70			.0002	.0010		.18	.0180	.0000	1.4	.0080	.03†
46,840	Aug. 18	v. slight	v. slight		.08	none	none	4.60			.0036	.0042		.22	.0160	.0000	1.3	.0260	.09*
47,175	Sept. 15	v. slight	slight		.10	v. faintly unpleasant	v. faintly unpleasant	4.30			.0050	.0036		.23	.0160	.0000	1.3	.0130	.09*
47,690	Oct. 20	none	v. slight		.00	none	none	5.00			.0030	.0014		.25	.0150	.0001	2.2	.0010	.06†
48,095	Nov. 17	none	none		.00	none	v. faintly unpleasant	4.70			.0004	.0016		.30	.0190	.0017	1.8	.0030	.05†
48,402	Dec. 21	slight	coars.		.02	none	none	3.70			.0070	.0032		.28	.0100	.0005	1.8	.0000	.06*

*Lower Boulevard Wells.

†Upper Boulevard Wells.

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH, LOWELL.
WATER ANALYSIS.—Pumping Station No. 1. (Parts in 100,000.)

No.	Date of Collection	Appearance.			Odor.		Residue on Evaporation.			Ammonia.		Chlorine.	Nitrogen as		Hardness.	Iron.	(Xylen Consumed.
		Turbid-ity.	Sedi-ment.	Color.	Cold.	Hot.	Total.	Loss on Ignition.	Fixed.	Free.	Total.		In Solu-tion.	In Sus-pen-sion.			
43,956	Jan., 1903 27 27	v. slight	v. slight	.03	none	none	5.00	..	..	.0036	.0028	.24	.0340	.0001	1.6	.0400	.08
44,323	Feb. 25	none	v. slight	.00	none	none	4.00	..	..	.0040	.0022	.27	.0440	.0000	1.8	.0300	.12
44,705	Mar. 25	none	none	.02	none	none	3.80	..	..	.0026	.0024	.22	.0400	.0000	1.8	.0100	.09
45,124	April 28	v. slight	v. slight	.02	none	none	3.90	..	..	.0030	.0022	.27	.0600	.0000	1.6	.0430	.04
45,529	May 27	v. slight	v. slight	.05	none	none	3.60	..	..	.0038	.0036	.21	.0210	.0000	1.1	.0630	.05
45,922	June 23	none	none	.00	none	none	4.00	..	..	.0004	.0014	.23	.0270	.0001	1.4	.0010	.03
46,388	July 22	none	none	.02	none	v. faintly unpleasant	3.60	..	..	.0000	.0020	.23	.0280	.0000	1.6	.0130	.04
46,841	Aug. 19	v. slight	v. slight	.06	v. faintly unpleasant	v. faintly unpleasant	4.20	..	..	.0022	.0042	.24	.0200	.0000	1.4	.0280	.10
47,176	Sept. 15	slight	v. slight	.07	faintly unpleasant	faintly unpleasant	4.10	..	..	.0018	.0032	.24	.0220	.0000	1.4	.0150	.10
47,691	Oct. 21	none	v. slight	.00	none	none	4.90	..	..	.0000	.0018	.29	.0300	.0000	2.0	.0100	.08
48,094	Nov. 17	none	none	.00	none	v. faintly unpleasant	4.90	..	..	.0008	.0020	.31	.0250	.0002	1.8	.0030	.05
48,461	Dec. 22	slight	slight	.03	none	none	4.80	..	..	.0036	.0032	.29	.0200	.0003	2.0	.0300	.06
















LOWELL WATER BOARD

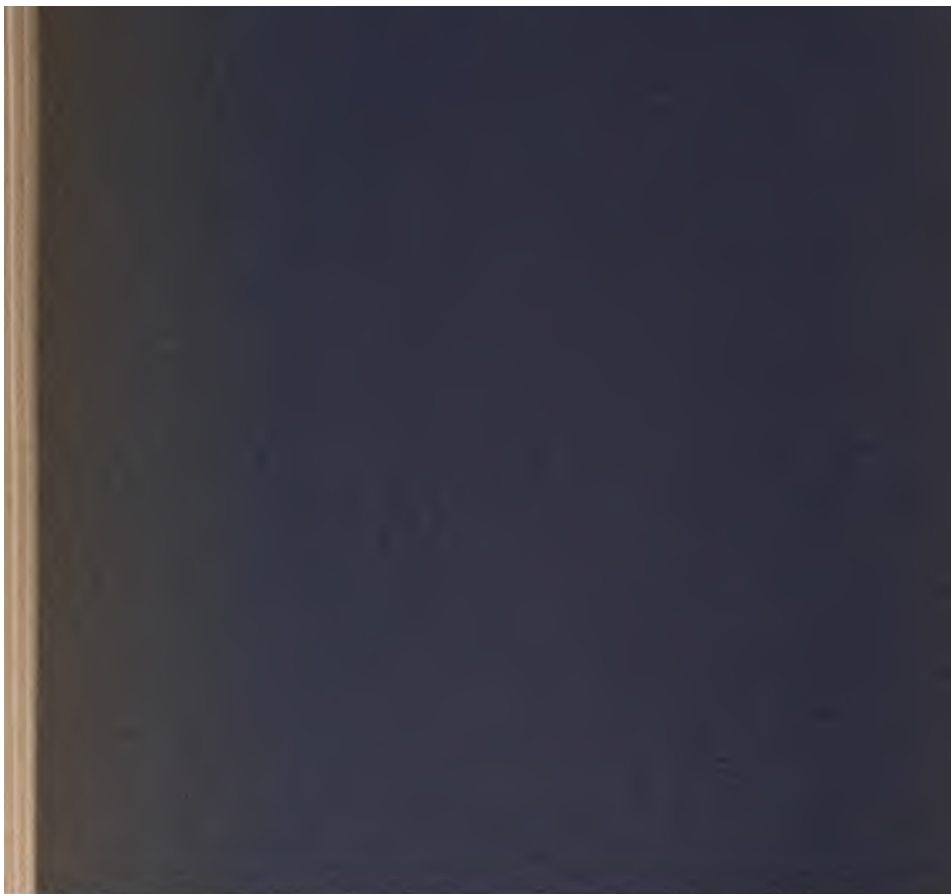


32nd Annual Report to the
City Council, of the
CITY OF LOWELL, MASS.

And the Reports of the Superintendent
of Water Works and City Engineer
TO THE WATER BOARD, FOR

1904





THIRTY - SECOND

ANNUAL REPORT

OF THE

★
Lowell Water Board

TO THE

City Council of the City of Lowell, Mass.

AND THE

**Reports of the Superintendent of Water Works
and of the City Engineer to the
Water Board for 1904**



LOWELL, MASS.:
BUTTERFIELD PRINTING COMPANY
1905

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.
1905

WATER DEPARTMENT, 1904

WATER BOARD

ROBERT J. CROWLEY, President.

Term expires second Monday in March, 1907.

MICHAEL J. DOWD.

Term expires second Monday in March, 1905.

AUGUST FELS.

Term expires second Monday in March, 1906.

FRANK L. WEAVER.

Term expires second Monday in March, 1908.

JOHN W. CRAWFORD, Secretary and Clerk.

ROBERT J. THOMAS, Superintendent.

GEORGE BOWERS, City Engineer.

D. B. H. BARTLETT, Engineer.

THOMAS McLOUGHLIN, Engineer.

JOHN B. HENRY, Keeper Reservoir.

THOMAS F. DOYLE, Foreman.

WILLIAM JOYCE, Assistant Foreman.

JOHN E. LOWNY, Meter Inspector.

ALBERT HALLOWELL, Foreman Shop.

A. F. COGER, Hydrants and Gates.

EDWARD WALSH, Services.

OFFICE

GEORGE E. WORTHEN, Service Clerk.

GERTRUDE W. BYAM, Bookkeeper.

JULIA J. RAFTER, Assistant Bookkeeper.

ALICE T. MCCARTHY, Assistant Bookkeeper.

INSPECTORS

ROBERT GARDNER.

FREDERICK A. BARON.

MICHAEL H. McCUE.

GEORGE F. TILTON.

WALTER P. WILEY.

CITY OF LOWELL.

IN BOARD OF ALDERMEN.

Feb. 14, 1905.

Received and ordered on file. Sent down for
concurrence.

GIRARD P. DADMAN,

City Clerk.

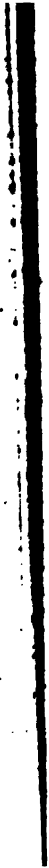
IN COMMON COUNCIL,

Feb. 21, 1905

Received and ordered on file, in concurrence.

FRANK M. DOWLING,

Clerk.



Report of the Water Board

OFFICE OF THE WATER BOARD,
CITY HALL.

Lowell, Mass., January 2, 1905.

*To His Honor the Mayor and the City Council of the
City of Lowell:*

Herewith is presented the thirty-second annual report of the Water Board for the year ending December 31, 1904. The report of the Superintendent herewith, covering the same period, contains the details of the work of the department, and renders an extended report from this Board unnecessary.

The personnel of the Board remained the same, as Mr. Weaver, whose time expired, was re-elected by the City Council ; but at the organization of the Board for the year, Mr. Robert J. Crowley was elected President of the Board, and Mr. Weaver retired from that office after a service of seven years.

The grounds and lands under the control of the Board have received the usual care, the land yields hay enough to supply the department and allow a con-

siderable amount to be sold. Problems are constantly coming up which must be solved and conditions change, but it is the aim of the Board to keep the plant in the highest state of efficiency, and also to look as far into the future as possible.

It has been the policy of the Board to make extensions so far as the means at its disposal would permit where most needed and where the revenue in sight would pay a fair interest on the amount expended.

The financial showing for the year is most satisfactory. Total receipts were \$197,073.64, an increase of 946.44 over previous year, and expenditures were \$181,298.24, a decrease of \$18,934.23. The balance January 1st, 1905, was \$18,835.32, an increase of \$15,775.40 over the year before. Owing to the thirty days limit on the 10 per cent. discount on bills for water, it is essential for the bills to bear the date of issue and to issue at stated times, so the quarterly bills are dated April 1st, July 1st, October 1st, and January 1st, instead of the March, June, September and December accounts as formerly; consequently, what would have been the December Account for 1904 becomes the January Account of 1905 and does not show in this report, but using the total of this account, the charges for metered water increased \$8,905.63 and rated water charges decreased \$2,481.63.

The changing from rates to meters is gradually going on, 277 new meters being set this year while only 178 new services were put in, not all of which were metered.

The final payment of \$5,000.00 was made on the second Driven Well loan of 1894 for \$50,000.00. The

debt of the Department was reduced \$21,600.00, leaving total debt January 1st, 1905, \$1,183,900.00, of which \$1,075,000.00 is bonds and \$87,300.00 is notes.

In February requisition was made through the Supply Department for one hundred tons of 6" pipe, which was purchased from the Lynchburg Foundry Co. for \$23.20 per net ton.

May 17th, requisition was made for three thousand tons of soft coal, either Pocahontas, New River Steam, Loyal Hanna or Old Maryland Co.'s; the contract was awarded Lowell Coal Co. for New River Steam Coal at \$4.55 per ton at Centralville, and \$4.75 per ton at Boulevard.

On November 17th, a proposition was received from the Power Specialty Co. to furnish a Foster Superheater, to be installed on boiler at Centralville Station, they guaranteeing a saving of fuel of 9 per cent. in the operation of the H. D. Worthington Engine when in good order, on sixty days trial, for the price of \$1050.00 at factory. This proposition was accepted and contract was signed and approved by the Mayor, December 31st.

In accordance with the rules adopted last year governing the use and care of private fire services, it seemed advisable to have a close inspection of the property where there are such services, that the rules shall be strictly adhered to, and Inspector Gardner was appointed to that duty to have all private fire services under supervision, to keep them sealed and learn when used and for what purpose. The city was also divided into four districts and the other four inspectors were detailed one to each district to read meters, make pick-up charges, deliver bills and look after the use of water

in his particular district. At the quarterly readings four other employees are detailed to assist these four inspectors that the meters may be read in the shortest time and the bills issued with as little delay as possible; and to do this another clerk was installed in the office, Miss Alice T. McCarthy being selected from the civil service list for that position.

There being considerable controversy among water works people, insurance men and mill officials as to the efficiency of fire services when metered, the Superintendent was authorized to install a suitable plant at Centralville Pumping Station for the testing of large meters and other devices for use on fire services, and on October 5th and 6th a public test of these appliances was held at which a large number of prominent water works, insurance and mill officials, together with representatives of a number of meter manufacturers were present, and showed much interest in the device and the results obtained. Superintendent Thomas and Engineer Sullivan received a great deal of praise from those present for their work in this matter.

This Board recommends that the land on the Boulevard under the jurisdiction of the Street Department, on which are the wells of the Lower Boulevard Pumping Station, shall be turned over to the care of the Water Department; the Water Department owns the land adjoining on which the Pumping Station stands and should have full control of that where the wells are.

It will soon become necessary to install new pumping machinery at Centralville Station, as the economical usefulness of the pumps there is about over. The Morris engine of 1873, the Worthington Duplex of 1876, and

the Worthington High Duty of 1861 when run are in continual need of repairs and cannot be depended upon for constant work. In the great advance in the manufacture of machinery for the pumping of water, it will be economy for the city to install a new pump in the near future, as well as a measure of safety.

On December 6th, 1904, occurred the death of Inspector Michael H. McCue after a long and painful illness, who had been employed in this Department since 1892. The department thus loses the services of a faithful and trustworthy employee. The vacancy thus created was filled by the election of Mr. John E. Lowney.

The statistics of the Secretary and of the City Engineer in their respective reports will be found of interest.

ROBERT J. CROWLEY.
MICHAEL J. DOWD.
FRANK L. WEAVER.
AUGUST FELS.

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1904.

TABLE I.	CHARGES				RECEIPTS BY ACCOUNTS			
	WATER			Total 1904	Receipts	Discounts	Abatements	Due
	Rate	Metered	Total					
Transfer.....	.....	.....	.....	\$38,879 05	\$34,086 19	\$2,732 02	700 11	1,480 73
March.....	.....	.....	.....	1,494 86	1,389 34	.....	15 76	89 76
April.....	.....	\$36,519 80	\$36,519 80	37,900 28	34,538 11	3,219 42	74 50	68 23
May.....	\$38,675 22	.....	38,675 52	38,675 22	35,097 36	3,125 52	335 92	116 42
June.....	.....	.....	.....	1,749 44	1,623 24	.....	24 65	101 55
July.....	1,540 25	51,375 40	52,915 65	55,079 30	49,991 56	4,583 60	143 51	360 63
August.....	.....	.....	.....	1,076 76	956 71	.....	43 75	76 30
September.....	.....	.....	.....	1,561 62	1,004 32	.....	9 25	348 05
October.....	1,289 78	42,505 58	43,795 36	45,637 74	36,259 04	3,811 81	273 67	5,203 22
November.....	.....	.....	.....	1,013 50	262 62	.....	17 54	733 34
December.....	.....	.....	.....	801 28	80 93	.....	.....	722 35
January '05	paid in advance	.....	.....	.....	1,226 21	245 88	8 14	.....
	\$41,505 25	\$130,400 78	\$171,906 03	\$223,869 05	\$197,055 63	\$17,718 25	\$1,646 80	\$9,530 60

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1904. — OUTGO.

TABLE II.	Pay Roll and Salaries	Water Works Supplies	Interest and Principle	Refund and Vacancies	General Expenses	Stable Department	Fuel	Land	Total 1904	Total 1903
January.....	\$5,372 52	\$1,797 45	\$ 840 00	\$ 19 43	\$227 45	\$150 84	.....	.....	\$8,407 69	\$20,831 63
February.....	4,590 24	544 76	1,837 50	44 68	43 15	18 54	\$ 495 11	.....	7,573 98	9,838 81
March.....	4,845 09	613 65	200 00	64 98	187 52	76 09	1,153 49	.....	7,140 82	13,270 76
April.....	6,680 04	2,979 60	.....	28 31	133 62	181 05	.....	.....	10,002 62	7,353 08
May.....	5,851 26	2,721 70	19,028 00	545 94	182 48	489 05	884 58	.....	29,702 98	28,157 65
June.....	5,574 09	1,856 58	500 00	97 83	888 61	81 08	.....	\$92 46	9,090 65	16,068 96
July.....	7,201 51	1,757 64	19,300 00	81 26	142 98	479 73	3,724 96	.....	32,688 68	31,888 72
August.....	6,132 72	1,974 73	1,897 50	72 97	68 29	140 46	6,088 55	.....	16,375 22	11,744 47
September.....	6,165 95	1,271 31	60 00	60 92	171 12	105 62	.....	.....	7,834 92	10,123 37
October.....	6,913 55	2,329 12	4,100 00	97 05	256 62	42 52	3,803 37	.....	17,542 20	13,891 17
November.....	5,699 29	2,551 75	19,468 00	32 54	73 45	7 84	.....	.....	27,832 87	40,022 49
December.....	5,891 06	1,127 06	.....	13 75	36 28	38 06	.....	.....	7,106 21	6,841 76
Total.....	\$70,917 32	\$21,525 35	\$67,231 00	\$1,159 63	\$2,411 57	\$1,810 85	\$16,150 06	\$92 46	\$181,298 24	\$260,232 47

FINANCIAL STATEMENT—LOWELL WATER WORKS, 1904.
SUBDIVISION OF "OTHER THAN WATER CHARGES" FROM TABLE I.

TABLE III.	Meters Sold	Expense Setting Meters	Repairs of Meters	New Services	Changed Services	Labor and Material	Shut off Fees	Interest	Total 1904	Total 1903
March	\$ 236 50	\$ 27 76	\$760 25	\$ 24 29	\$14 75	\$431 31	.....	.....	\$1,494 86	\$1,987 43
April	638 25	69 91	207 78	121 33	66 60	276 61	.....	.....	1,380 48	2,559 17
May .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,942 91
June	684 00	97 83	295 63	258 08	47 51	366 39	.....	.....	1,749 44	1,099 65
July	1,046 50	122 42	122 05	278 07	65 48	525 13	\$ 4 00	.....	2,163 65	1,210 21
August	259 75	33 47	18 60	252 58	16 50	495 86	.....	.....	1,076 76	1,171 79
September	650 50	80 62	138 98	261 10	4 38	414 04	12 00	.....	1,561 62	1,141 18
October	711 25	83 31	52 31	228 77	48 90	466 14	.....	\$235 70	1,842 38	1,341 96
November	237 25	60 71	56 53	166 66	20 68	471 67	16 00	.....	1,013 50	1,340 69
December	174 75	23 80	91 71	136 09	.....	374 93	.....	.....	801 28	939 39
Total	\$4,638 75	\$599 83	\$1,743 84	\$1,726 97	\$284 80	\$3,822 08	\$32 00	\$235 70	\$13,083 97	\$14,734 38

FINANCIAL STATEMENT — LOWELL WATER WORKS, 1904.
SUB-DIVISION OF "PAY ROLL AND SALARIES" FROM TABLE II.

TABLE IV.	Salaries	Meter Work	Office and Inspectors	Extension and Construct'n	Engineer- ing	Centralville-Cook Wells Pumping Station	Boulevard Pumping Station	Services	Recharged	General Maintenance	Total 1904	Total 1903
January.....	\$283 32	\$269 39	\$731 12	\$ 81 97	\$271 69	\$717 58	\$537 86			\$2,412 09	\$5,372 52	\$5,803 83
February.....	283 36	214 37	681 28	76 50	100 00	673 44	546 80			1,812 86	4,590 24	4,989 08
March.....	283 32	388 37	681 28	76 50	125 00	673 44	464 80	\$ 16 98		2,003 58	4,845 09	4,730 31
April.....	283 32	307 28	851 60	573 18	100 00	927 30	552 25	145 74		2,838 55	6,680 04	5,043 72
May.....	283 36	237 94	681 28	638 25	100 00	680 44	502 80	139 91	\$ 7 50	2,516 78	5,851 26	6,908 96
June.....	283 32	258 75	681 28	369 19	125 00	680 44	504 80	168 16	16 88	2,425 52	5,574 09	5,843 77
July.....	283 32	264 50	878 60	665 35	100 00	879 75	673 75	279 22	39 86	3,003 47	7,201 51	5,957 17
August.....	283 36	217 29	717 28	981 80	100 00	593 09	620 53	297 64		2,121 55	6,132 72	6,978 92
September....	283 32	243 19	717 28	1,216 80	125 00	698 80	542 55	257 30		2,039 08	6 165 95	5,477 28
October.....	283 32	306 00	896 60	370 96	100 00	893 66	778 98	327 07	27 38	2,873 58	6,913 55	6,544 97
November....	283 36	227 00	717 28	147 49	100 00	795 51	548 30	162 58		2,661 77	5,699 29	5,563 27
December....	283 32	318 54	895 03	239 92		859 49	681 04	110 25	34 00	2,399 47	5,891 06	5,534 93
Total.....	\$3,400 00	\$3,252 62	\$9,129 91	\$5,437 91	\$1,346 69	\$9,072 94	\$1,184 02	\$6,954 46	\$125 62	\$29,108 30	\$70,917 32	\$69,376 21

TABLE V.

**FINANCIAL STATEMENT—LOWELL WATER WORKS,
1904.**

(SUB-DIVISION "WATER WORKS SUPPLIES," FROM TABLE II.)

Pumping Station Supplies, Centralville Station.....	\$1,441 72
Pumping Station Supplies, Cook plant.....	393 76
Pumping Station Supplies, Boulevard.....	704 98
Cast iron pipe and specials.....	3,577 98
Hydrants and gates and gate boxes.....	2,814 21
Service pipe and boxes.....	2,506 26
Meters.....	4,169 42
Machinery and tools.....	106 98
Brass foundry.....	52 68
Miscellaneous.....	3,428 57
New office building.....	2,328 79
	<hr/>
	\$21,525 35

TABLE VI.

FINANCIAL STATEMENT—LOWELL WATER WORKS,
1904.

DETAIL OF "PRINCIPLE AND INTEREST" FROM TABLE II.

	Amount of Debt Jan. 1, 1904.	Rate.	Interest Paid 1904.	Paid on Notes 1904.	Amount of Debt Jan. 1, 1905.
Water loan bonds	\$1,000,000 00	4	.....	.....	\$1,000,000 00
57 Coupons, No. 26...	.....	.....	\$ 1,140 00	.....	.....
994 Coupons, No. 27	.....	.....	19,880 00	.....	.....
874 Coupons, No. 28	.....	.....	17,480 00	.....	.....
High Service bonds...	75,000 00	4	.....	.....	75,000 00
15 Coupons, No. 45...	.....	.....	1,500 00	.....	.....
13 Coupons, No. 46...	.....	.....	1,300 00	.....	.....
NOTES.	5,000 00	3½	175 00	5,000 00	.....
	16,400 00	4	656 00	4,100 00	12,300 00
	35,000 00	4	1,400 00	5,000 00	30,000 00
	52,500 00	4	2,100 00	7,500 00	45,000 00
	\$1,183,900 00		\$45,631 00	\$21,600 00	\$1,162,300 00

TABLE VII.

FINANCIAL STATEMENT—LOWELL WATER WORKS.
1904.

MAINTENANCE AND CONSTRUCTION ACCOUNT.

MAINTENANCE.

Paid for labor:

Salary of Superintendent.	\$ 1,800 00
Salary of Water Board.....	1,600 00
Office and Inspectors.....	9,129 91
Pumping stations.....	17,211 42
Meter Work.....	3,252 62
Engineering.....	1,346 69
General maintenance.....	29,173 96

Paid for material:

Output as per stock book.	1,930 15
General expense.....	2,411 57
Stable.....	1,810 85
Pumping station supplies.....	2,540 46
Fuel.....	16,150 06
Interest.....	45,631 00

\$133,988 69

CONSTRUCTION.

Paid for labor.....	\$ 7,277 10
Land.....	92 46
New office building.....	2,328 79
Output as per stock book.....	6,465 70
Payment on loans.....	21,600 00

\$37,764 05



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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

Superintendent's Report

LOWELL, MASS., January 2, 1905.

To the Lowell Water Board:

GENTLEMEN: In accordance with the provisions of the City Ordinances, I have the honor of rendering to you the Annual Report of the Superintendent of Water Works for the year ending December 31, 1904.

In the report of 1903 mention was made of the favorable showing in the daily consumption of water for that year, it being the lowest of any year since 1889. This year I take pleasure in calling attention to the fact that the total expenditures for 1904 were less than in any year since 1887, with the single exception of the year 1891, when it was \$180,250.56, against \$181,298.94 the past year. In 1891, however, the city water was pumped directly from the Merrimack River into the reservoir, while now it is first pumped from the wells, then re-pumped into the reservoir, thereby doubling the pumping expenses. This shrinkage in the annual expenditures indicates, among other things, that the department is recovering from the burden of indebtedness consequent upon the construction of the driven well system. Re-

ferring to 1891 recalls an impressive and significant fact; that is, about that time, 1890-91, Lowell's typhoid fever death rate was exceeded by only two or three cities in the world, and its mortality record was 24.95. During the last year the city's typhoid fever death rate is one of the lowest in the world, while the rate of mortality from all causes for 1904 is only 16.62, the lowest since 1850. That this great improvement in the health of the people of Lowell is due to a considerable extent to the city's magnificent water supply, goes without question. Moreover, since 1891, the water works under the control of your honorable board, has grown and prospered so that it is now a more valuable asset than the rest of the city's property combined.

During the past year an improvement has been made in the property of the department by the erection of a new office building, thus making available for shop purposes a much needed space in the machine shop occupied by the old office. As authorized by your honorable body, this building is of brick one story high, with granite coping and trimmings. It is especially designed for office work. The inside walls are finished in quartered oak, part panelled with panelled metallic ceiling. The office proper has a floor space of 15' x 20', and is connected by an iron stairway with a basement which is intended to be used for storing books, records, etc. It is situated on the northwest corner of the machine shop, commanding a good view of the shop, yard, stable and storehouse. By means of push buttons and electric bells those employed in the engine room, blacksmith shop, carpenter shop, machine shop, stable and paint shop, can be called to the office when needed.

PLANT FOR TESTING LARGE METERS.

For the purpose of testing large meters, such as 4", 6", etc., or other devices for measuring water, a testing plant has been set up in the engine room of the Central-ville pumping station. This plant consists of an 8" pipe laid in the basement of the pumping station, from the high service main to the engine room floor, where it is reduced 6" pipe and extended along on wooden horses to a point where the water after passing through the meters can be discharged into the pump well. The 6" pipe line in the engine room where the meters are set for testing, is equipped with pizometer rings connected to a U gauge and mercury column, with Freeman nozzles attached for measuring the discharge. This plant was set up in March, since which time 7-6", 1-10", 1-12" meters and three devices were tested. All meters to be used for fire service can be tested at this plant, both for registration and for loss of head. The testing has been conducted by W. F. Sullivan, of the city engineer's force, in a most thorough and comprehensive manner. Many of the tests made are new, and considerable data as to the practical working of these large meters has been obtained that was heretofore unknown. Cards and diagrams have been made by engineer Sullivan, showing the operation of every meter and device tested, with varying volumes of discharge, loss of head and percentage of registration.

MAIN PIPES, EXTENSIONS, ETC.

There is now a total of 133.68 miles of cast iron main pipe in use, a gain of 5706 feet during the year. Besides the extension of mains, change in street lines

various purposes. This should not be; it is a bad practice and may some day be the cause of serious results. The City Ordinances distinctly forbid the opening of hydrants, excepting for fire, without permission of the Water Board. Sometimes hydrants are found in a totally disabled condition after being used by some unauthorized person; just such a circumstance might be the means of allowing a fire to gain great headway and ultimately develop into a conflagration. Following the lessons taught by the disastrous experiences of Baltimore, Patterson, Lynn, and other places, every care should be exercised in maintaining the fire hydrants and fire service of the city to the highest possible point of efficiency.

HYDRANTS, JANUARY 1st, 1905

KIND		2 Noz.	3 Noz.	4 Noz.	Total
Boston Machine			170		170
Chapman		3	104	50	157
Coffin			1		1
Corey			7		7
Eddy			32	1	33
Flush	426				426
Glanmorgan			1		1
Holyoke				1	1
Kennedy			2		2
Ludlow		3	264	14	281
Michigan			43		43
O'Brien			1		1
Perkins				1	1
Walker			3		3
Lowrey	11				11
Totals	437	6	628	67	1138

PRIVATE FIRE SERVICE AND HYDRANTS.

Two fire services were laid during the year, as follows: 4" pipe for the Young Women's Christian Association, John street and John avenue; U. S. Spool and Bobbin Co., 4" on Perry street. Fifteen 12" and two 8" connections with the Locks and Canals System for corporation fire service were cut off and gates removed. There are now in all 124 private fire services supplying 74 private fire hydrants besides sprinklers and stand pipes, all of which were sealed during the year by Inspector Gardner, who was especially detailed for the inspection of fire services. His duties also include the reading of meters on premises provided with this extra protection, and to observe and report any failure to comply with the rules of the department governing private fire services. So far, his work has amply justified his appointment.

PRIVATE HYDRANTS JANUARY 1st, 1905.

KIND.	1 Noz.	2 Noz.	3 Noz.	4 Noz.	Total
Boston Machine		1	8		9
Chapman	1	4	1	5	11
Coffin			1		1
Flush 3					3
Kenney		1			1
Ludlow		18	14	10	42
Michigan			3		3
Perkins		3	1		4
Totals 3	1	27	28	15	74

SERVICES.

The number of house services or house connections have increased one hundred and seventy-eight (178) during the year, against one hundred and fifty five (155) the previous year and forty-three old services of various kinds of pipe were replaced with new pipe, principally Tin Lined Iron. Only thirty-five services were changed the previous year. An unusual number of services were also repaired owing to the severe cold spell last January when several were frozen and burst. Regrading of streets have made necessary the lowering of many services. Owing to the extra work as above, the expenses for service pipe for the year were \$2,725.37 an increase over the year previous of \$1,468.61. In the line of service maintenance 367 curb boxes were set and 10 leaks on service pipes repaired.

NEW SERVICES—1904.

160	$\frac{3}{4}$ " iron tin lined pipe.....	6,142 feet
7	1" iron tin lined pipe.....	116 "
2	1½" iron tin lined pipe.....	70 "
2	2" iron pipe.....	88 "
3	4" iron pipe.....	112 "
3	$\frac{5}{8}$ " lead pipe.....	79 "
1	$\frac{3}{4}$ " lead pipe.....	31 "
<hr/>		<hr/>
178		6,638 "
	Amount previously laid.....	438,973 feet
	Total now laid.....	445,611 "
	Total services laid.....	12,058
	Total cut off at main.....	832
	Total reconnected.....	61
	Total now in use.....	11,287

SERVICES CHANGED—1904.

No.	KIND.	CHANGED TO						Total Feet
		Tin Lined $\frac{3}{4}$ "	Tin Lined 1"	Tin Lined $1\frac{1}{2}$ "	Iron $\frac{3}{4}$ "	Iron 1"	Iron $1\frac{1}{2}$ "	
23	$\frac{3}{4}$ " iron . .	511						511
3	$\frac{3}{4}$ " iron . .		63					63
1	$\frac{3}{4}$ " iron . .			14				14
1	$\frac{3}{4}$ " iron . .				6			6
3	1" iron . .	64						64
1	1" iron . .		21					21
1	1" iron . .			23				23
1	$1\frac{1}{2}$ " iron . .		95					95
1	$1\frac{1}{2}$ " iron . .						7	7
1	$\frac{3}{4}$ " T. L. iron .			18				18
1	1" L. L. iron .					5		5
2	$\frac{5}{8}$ " lead . .	41						41
1	$\frac{5}{8}$ " lead . .		49					49
2	$\frac{3}{4}$ " lead . .		48					48
1	$\frac{3}{4}$ " lead . .			67				67
43	Totals .	616	276	122	6	5	7	1032

The total number of meters in use at the close of the year was 7513, representing 66% of the total number of services in use. During the last four years there has been a net gain of 1927 meters in use in the department. One of the results of this rapid increase in meters has been a slight reduction in the total receipts, but to offset that there has been also a material decrease in the daily consumption of water, which in turn has made possible the reduction in the total expenses.

The large number of meters frozen and burst during the winter of 1903 and 1904 (particularly last January) not only in Lowell, but in many other cities in the country, has had the effect of bringing to the attention of Water Departments the advantages of setting meters in boxes located in the sidewalk. Their liability to freeze when set in the ground with an air tight box is reduced to a minimum, while their accessibility to the Inspector for reading makes it possible to read them faster than the present method of going into cellars for that purpose with all that entails, such as calling and finding the family away and the house and cellar locked, or possibly a pile of wood or coal placed over the meter, making a second call necessary. Another advantage of out side meters is that leaks in the service pipe beyond the sidewalk are all registered. During the year several meters were set in the ground as above described.

PRIVATE METERS RUNNING JANUARY 1, 1905

SIZES.	$\frac{3}{8}$ "	$\frac{5}{8}$ "	$\frac{3}{4}$ "	1"	1½"	2"	Total
Columbia . . .		9					9
Crown	1	29	23	2	1		56
Desper			3	1			4
Duplex		1					1
Empire		6					6
Frost		2	1				3
Hersey		16	1				17
King		1					1
Lambert		12					12
Nash		14	2			1	17
Thomson			1				1
Trident			6				6
Worthington . .				1		3	4
Total	1	90	37	4	1	4	137

METERS RUNNING JANUARY 1st, 1905.

Size.	$\frac{5}{8}$ "	$\frac{3}{4}$ "	1"	1 $\frac{1}{2}$ "	2"	3"	4"	6"	Total
Columbia .	108	4							112
Crown .	2760	1582	302	19	20	5	5	2	4695
Desper .	19	6	5						30
Duplex .	1	1	4						6
Empire .	231	40	4						275
Frost .		1							1
Gem .					7		4	2	13
Hersey .	485	102	8	5			1		601
King .	6								6
Lambert .	538	72							610
Metropolitan		1							1
Nash .	149	73	45		1				268
Niagara .	1	1							2
Thomson .	5	19	2						26
Trident .	503	30	1						534
Union .	28	7		1					36
Worthington	112	23	52	66	35	6	3		297
Total .	4946	1962	423	91	63	11	13	4	7513

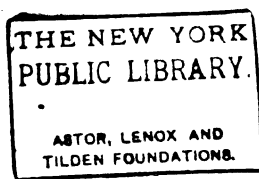
New meters set.....	277
Meters out of repairs.....	900
Meters repaired in cellars.....	215
Meters reset.....	795
Meters condemned	27
Meters condemned replaced with new	28
Meters frozen and burst.....	367
Meters discontinued	39
Private meters set.....	16

PUMPING STATIONS AND PUMPING.

Taking the work of all the Pumping Stations together, there was a gross pumpage for the year of 4,108,816,873 gallons. Deducting the quantity pumped at Boulevard Lower Pumping Station, 1,158,489,736 gallons and the Boulevard Upper Station, 874,664,382 gallons which had to be re-pumped, and after allowing a certain amount for condensation at Centralville Pumping Station, the net pumpage or the total quantity of water pumped for distribution was 2,007,487,767 gallons, of which 63,947,712 gallons was pumped at the No. 2 or Cook Wells Pumping Station from the Cook and Washington Wells. This Station was started and ran five days not because it became necessary, but more for the purpose of trying it out and making sure that everything was all right in case of an emergency, and although the boilers and pipes were empty and some of the pipes disconnected, yet within six hours after receiving notice the Engineer had the Station in successful operation. Part of the main steam line at this Station which when first put up in 1893 was only second hand C. I. pipe, leaked so badly that it was thought best to replace it with new W. I. 6" pipe. As no steam is kept in the boilers when not running, care must be used in draining boilers, pipes, etc. to prevent freezing. For this reason, also, the feed water heater was changed from a horizontal to vertical position so that it could be more perfectly drained. Should occasion arise this Station could be started in a few hours.



APPARATUS FOR TESTING LARGE METERS AND FIRE SERVICE DEVICES.



THE BOULEVARD PUMPING STATIONS.

The Boulevard Upper Pumping Station was run considerable the past year because it required about 3,000 lbs. less coal to pump 5,000,000 gallons than did the Lower Pumping Station; no repairs of any account were made at the Upper Station, but while it was running the pumps and boilers at the Lower Station were overhauled and put in order.

CENTRALVILLE PUMPING STATION.

Most of the pumping at this Station was done by the Morris Engine. It ran very smoothly and proved comparatively economical in the use of fuel, for which reason it would have been run more, but it has a peculiar way of breaking down in some vital part which requires several days or weeks to repair; for instance, it was out of commission until February 27th, awaiting a new filling-in piece belonging between the high-pressure steam cylinder and the condenser, which was broken the year before. Later in the year the crank pin was noticed working loose and examination showed it to be an imperfect fit and a new one had to be forged and forced in. Since then the Engine has run very well and with only slight repairs.

The High Duty Worthington Pump which has been the main reliance of this Pumping Station for the last

ten years required considerable attention during the year. It showed signs of weakening the year before and called for extensive repairs but the past year after fitting it with a new foot valve, supposing that would prove all that was necessary to make it run all right again, serious trouble was encountered which, upon investigation, proved to be due to a crack in Low Pressure Steam Cylinder about seven inches long and extending through the jacket. White metal was melted down and run into the crack from the inside of the cylinder and for the purpose of stopping leakage through it; but the live steam pressure in the jackets loosened the metal patch so that the jacket pressure had cut out altogether; of course that reduced the efficiency of the engine materially. However, the Superheater contracted for by Your Honorable Board may prove an offset to the loss of the jacket steam and enable the engine to do as well as ever or better, as the Contractors furnishing the Superheater guarantee.

Occasionally during the year necessity compelled the running of the Low Duty Worthington Pump. It takes, however, so much coal to pump the daily supply of water with it that it is like wasting money to have to do so. For illustration, the Morris Engine pumping $5\frac{1}{2}$ million gallons consumes 13,000 lbs. while 17,000 lbs. is burned when the Low Duty Worthington is running, doing the same work.

Taking it as a whole, the Department is in good condition and it stands first class, particularly as to the quality and quantity of its supply. It must be admitted, however, that its pumping outfit is lamentably weak and inefficient and though the financial showing for the

Department the past year is as good as far as the expenditures are concerned, a still further saving could be effected if the pumping equipment of the Department was brought up-to-date. A new pump to take the place of the Low Duty Worthington ought to be considered as soon as possible.

RESERVOIRS.

As customary, every summer since the introduction of Driven Well water, in order to avoid trouble from Algae, the High Service Reservoir was shut off and the water for that system pumped directly into the mains. No such measures have been found necessary for the last three summers regarding the Low Service Reservoir, although during the past summer a large abundance of green growth, presumably Algae, was plainly observable on the walls of the reservoir, much of which was removed by hand; yet it had no apparant effect on the odor or taste of the water drawn from the reservoir.

The only outlay on account of the reservoir was the rebuilding of a part of the fence on Christian Street.

MISCELLANEOUS.

Two new drinking fountains for people were set during the year; one at Hosford Square and one in Pawtucketville on Mammoth Road near the corner of

Riverside Street. A combination drinking fountain made of 30" cast iron pipe was set on Broadway opposite the Mann School. All the fountains were cleaned twenty times, and 151 complaints regarding fountains were attended to. The streets mains were blown off as usual during the year.

At the parks along the Conduit in Pawtucketville and at the Pumping Station and Reservoir grounds flowers were set out, making them look more beautiful than ever before.

On January 1st of the past year a break occurred in the 30" force main on Sixth Street near the corner of Read Street. Outside the injury done to the surface of the street by the escaping water, no other damage was done. In order to repair it, 7 feet of new 30" pipe had to be used.

An examination of the Conduit revealed a bad spot in the brick work under Third Avenue. This was repaired and the Conduit, Tunnel and Filter Gallery thoroughly cleaned. The tunnel was flushed with hose connected to near-by hydrants.

Hay of good quality to the extent of about 40 tons was cut off the lands of the Department at the Reservoir and on the Boulevard. A considerable quantity of the previous year's crop being left, over twelve tons of it was sold, realizing a sum of money sufficient to meet the expense incurred in cutting and saving the whole crop.

Two new horses were purchased during the year and two old ones sold. Twenty-four sewers were flushed during the year, and seven flush hydrant boxes were renewed.

CONCLUSION.

It affords me satisfaction to be able to acknowledge my sincere thanks to President Crowley and the members of the Board for their kind and considerate treatment during the year.

Respectfully submitted,

ROBERT J. THOMAS,
Superintendent.

LOW SERVICE—WATER PIPES LAID IN 1904.

Streets.	Between What Streets.	Length in Feet.					Total.
		4-in.	6-in.	8-in.	10-in.		
Alken	Ford and Cheever		201				201.0
Beaulieu	Northerly from West Sixth		308				308.0
Cashin	Southerly from Princeton		505				505.0
City Ave.	Easterly from City Hall Ave.	77					77.0
City Stables	Cart sprinkler standpipe	36					36.0
Corey	Southerly from Princeton		144				144.0
Dana	Northerly from Latham		319				319.0
Dartmouth Ave.	Westerly to Hildreth		1090				1090.0
Eaton	Extended southwesterly		72				72.0
Grace	Northerly to Liberty		223				223.0
Inland	Easterly from Blodgett		146				146.0
John Ave.	Westerly from John	46					46.0
John Ave.	Fire Service to Y. W. C. A. building	10					10.0
Lipton	Southerly to Forest		200				200.0
Middlesex	On street car sprinkler standpipe west of Baldwin	11					11.0
Moody	Extended northerly			639	454		1093.0
Olney	Westerly from Gorham		99				99.0
Orchard	Extended northerly		84				84.0
Perry	Fire service to U. S. Spool and Bobbin Co.	79					79.0
Plymouth	Extended southerly		130				130.0
Porter	Extended easterly		48				48.0
Third Ave.	Westerly from Crawford		144				144.0
West	Northerly from Blossom		72				72.0
West Sixth	Westerly to Beaulieu		154				154.0
West Sixth	Southerly towards Ennell		48				48.0
	Hydrants		206				206.0
	Laid in 1903	259	4317	639	454		5669.0

HIGH SERVICE—WATER PIPES LAID IN 1904.

Streets	Between what Streets	Length in Feet					Total
		4 in.	6 in.	8 in.	10 in.	12 in.	
Whitman.....	Easterly from Fairmount.....	.....	37.5	.....	.....	.....	37.5
	Laid in 1904 .....	.....	37.5	.....	.....	.....	37.5
	High Service laid previous to 1904 .....	.....	.....	.....	.....	.....	37884.5
	Total High Service to Jan. 1, 1905 .....	.....	.....	.....	.....	.....	37922.0

Brought forward	5,669.0 feet
Low Service laid previous to 1904	662,228.0 feet
<hr/>	
Total Low Service to January 1, 1905	667,897.0 feet
Total High Service to January 1, 1905	37,922.0 feet
<hr/>	
Total High and Low Service to January 1, 1905..	705,819.0 feet
Total in miles, 133.68	

CHANGES

By street, 430 ft. 6 in. pipe relocated.
 Fruit street, 350 ft. 6 in. pipe relocated.
 Riverside street, 225 ft. 8 in. pipe relocated.

Corporation fire service connections and gates taken out during 1904.

12 in. connection to Appleton Co., Jackson street.
 12 in. connection to Bigelow Carpet Co., Market street.
 12 in. connection to Boott Cotton Mills, Amory street.
 12 in. connection to Hamilton Mfg. Co., Jackson street.
 12 in. connection to Lawrence Mfg. Co., Hall street.
 12 in. connection to Lowell Machine Shop, Dutton street.
 12 in. connection to Lowell Machine Shop, Jackson street.
 12 in. connection to Mass. Cotton Mills, Canal street.
 12 in. connection to Merrimack Mfg. Co., foot of Dutton street.
 12 in. connection to Merrimack Mfg. Co., foot of Dutton street.
 8 in. connection to Middlesex Co., Warren street.
 8 in. connection to Middlesex Co., Warren street.
 12 in. connection to Prescott Mills, Merrimack square.
 12 in. connection to Tremont and Suffolk Mills, Tremont street.
 12 in. connection to Tremont and Suffolk Mills, Tremont and Hall.
 12 in. connection to Tremont and Suffolk Mills, Hall and Suffolk.
 12 in. connection to Tremont and Suffolk Mills, Cabot street.

LOW SERVICE—LIST OF STOP GATES SET DURING THE YEAR 1904.

STREETS	LOCATION	4-in.	6-in.	8-in.	10-in.	12-in.	16-in.
Aiken	19.2 ft. west of east line Ford street, 5.3 ft. north of south line Aiken street	1					
Aiken	51.4 ft. east of west line Aiken street canal bridge, 4.7 ft. north of south line canal bridge	1					
Amory.....	On hydrant connection near entrance to Mass. Cotton Mills	1					
Amory.....	On hydrant connection 18.2 ft. north of south line Amory street, 9 ft. east of east line John street	1					
Amory.....	On hydrant connection 18 ft. north of south line Amory street 7½ ft. west of west line John street	1					
Beaulieu... ..	12 ft. east of west line Beaulieu on north line West Sixth street	1					
*By.....	Relocation 11½ ft. south of north line By street, on east line Hildreth street	1					
Canal	On hydrant connection near entrance to Mass. Cotton Mills	1					
*Chelmsford..	31.3 ft. east of west line Chelmsford street, on north line Daly street					1	
City Stables ...	On supply to sprinkler cart standpipe	1					
Dana	12 ft. east of west line Dana street, on north line Ludlam street	1					
Dartmouth Ave	12 ft. north of south line Hildreth street, 14.3 ft. west of east line Hildreth street	1					
Dutton.....	On hydrant connection near entrance to Lowell Machine Shop	1					
Dutton.....	41.4 ft. south of S. E. Cor. House No. 675, on west line Wamesit court					1	
Fort Hill Park	55½ ft. south of north line Rogers street 9½ ft. west of stone fender	1					
French	On hydrant connection 8½ ft. east of west line Kirk street	1					
Gates.....	14.2 ft. west of east line Gates street on north line Westford street	1					
Grace.....	12 ft. east of west line Grace street on south line Liberty street	1					
Grand	15.4 ft. west of east line Grand street, on north line Westford street	1					
Grand	16.5 ft. south of north line Grand street, 0.3 ft. east of west line Chelmsford street	1					
Howard.....	23.2 ft. north of south line Howard street, on west line Chelmsford street					1	

* 6 in. gate By street at Hildreth relocation. 12 in. gate Middlesex near Gorham relocation. 12 in. gate taken out Chelmsford street at Howard street.

LOW SERVICE—LIST OF STOP GATES SET DURING THE YEAR 1904—Continued.

STREETS	LOCATION	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.
Hurd	On hydrant connection, southerly side, near George street	1					
Jackson	On hydrant connection, west of entrance to Lowell Machine Shop	1					
John Ave.	6 ft. north of south line John avenue, 17.7 ft. east of west line John street	1					
Lawrence	25.7 ft. east of west line Lawrence street, on south line Ames street				1		
Lawrence	14 ft. west of east line Lawrence street, 41.8 ft. south of south line Sherman street				1		
Lipton	12 ft. east of west line Lipton street, 11.7 ft. south of north line Forrest street	1					
London	20.1 ft. south of north line London, on east line Main street	1					
Market	21 ft. west of west line Palmer street, 18.8 ft. south of north line Market street					1	
Merrimack	33 ft. south of north line Merrimack street, 13 ft. east of west line Hanover street				1		
Merrimack	29.7 ft. south of north line Merrimack street, 3 ft. east of east line Old City Hall	1					
Merrimack Sq.	On hydrant connection, northerly side, opp. Prescott Mills Building	1					
Merrimack Sq.	On hydrant connection, northerly side, in front Runels Building	1					
Middlesex	On street car sprinkler standpipe, 23.3 ft. north of south line Middlesex, 148 ft. west of west line Baldwin	1					
*Middlesex ...	(Relocation) 17.7 ft. north of south line Middlesex, 33.4 ft. west of west line Gorham street				1		
Middlesex	16.3 ft. south of north line Middlesex, 0.9 ft. west of west line School street			1			
Moody	13 ft. north of south line Moody street, on west line Seventh ave			1			
Olney	12 ft. south of north line Olney street, 15.7 ft. east of west line Gorham street	1					
Perry	On fire service to U. S. Spool and Bobbin Co., 10.9 ft. east of west line Perry st., 53 ft. north of north line building	1					
Riverside	25.7 ft. south of north line Riverside street, 1.5 ft. east of east line White street			1			
Warren	On hydrant connection, southerly side, opp. Middlesex Co.'s office	1					
West	10 ft. west of east line West st., on north line Blossom st.	1					
Worthen	On hydrant connection, easterly side opp. Merrimack Print Works	1					

* 6 in. gate By street at Hildreth relocation. 12 in. gate Middlesex near Gorham re. location. 12 in. gate taken out Chelmsford street at Howard street.

HIGH SERVICE—LIST OF STOP GATES SET DURING THE YEAR 1904.

STREETS	LOCATION	4 in.	6 in.	8 in.	10 in.	12 in.	16 in.
Whitman	13 ft. south of north line Whitman street, 17.7 ft. east of west line Fairmount street	1					

**LOW SERVICE—LIST OF HYDRANTS SET DURING
THE YEAR, 1904.**

STREETS	LOCATION
Amory	At entrance to Mass. Cotton Mills.
Amory	Southerly side, east of John street.
Armory	Southerly side, west of John street.
*Canal	At entrance to Mass. Cotton Mills.
Dutton	Easterly side, just north of entrance to Lowell Machine Shop.
French	Opposite Kirk street near Merrimack Co.'s storehouse.
Hurd	Southerly side, near George street.
Jackson	Northerly side, west of entrance to Lowell Machine Shop.
Merrimack Sq.	Northerly side, opp. Prescott Mills.
Merrimack Sq.	Northerly side, in front Runels building.
Plymouth	Easterly side, in front No. 25.
Warren	Southerly side, opp. Middlesex Co.'s office.
Worthen	Easterly side, opp. Merrimack Print Works.

* Old flush hydrant discontinued.

CAST IRON PIPE AND SPECIALS IN STOCK DEC. 31, 1904.

Size in inches	4"	6"	8"	10"	12"	16"	20"	24"	30"
Lengths of pipe	2	244	133	1	121	9	11	17	2
Sleeves	1	3	4	2	3	7	1	5	1
Caps.....	.....	4	1	.....	2	2	1	1	.....
Plugs.....	1	15	8	4	2	2	1	.....	.....
$\frac{1}{4}$ Bends.....	.....	1	3	1	6	5	.....	.....	.....
$\frac{1}{2}$ Bends.....	4	7	12	.....	2	8	6	4	.....
$\frac{3}{4}$ Bends.....	4	2	6	.....	5	9	5	.....	2
Offsets.....	3	2	8	1	.....	.....	.....	.....	.....
Gates.....	.....	4	2	.....	8	.....	.....	.....	.....

CAST IRON PIPE IN PIECES.

64 feet 4" pipe.	47 feet 6" pipe.	50 feet 8" pipe.
38 feet 10" pipe.	30 feet 12" pipe.	13 feet 16" pipe.
5 feet 30" pipe.		

HYDRANTS, COVERS, ETC.

1 Lowrey hydrant, 3 Walker hydrants, 3 Corey hydrants, 5 Flush hydrants, 1 frame and cover for Lowrey hydrant, 15 Flush hydrant frames, 6 Stone gate covers, 4 frames and covers for Meter boxes, 25 Iron gate boxes, 15 frames and covers for gate boxes, 1 30" Manhole, 23 bottoms for gate boxes 4 feet long; 9 5 feet long; 6 6 feet long, 7 $1\frac{1}{2}$ " Sidewalk boxes, 26 1" Sidewalk boxes.



Report of the City Engineer

OFFICE OF CITY ENGINEER.

LOWELL, MASS., January 1, 1905.

To the Lowell Water Board:

GENTLEMEN:—I have the honor to submit the Thirty-second Annual Report, for the year ending December 31, 1904.

PUMPAGE.

Total net pumpage for 1904.....	2,007,487,767 Gallons.
Total net pumpage for 1903	1,923,370,860 Gallons.
An increase in 1904 of.....	84,116,907 Gallons.

CONSUMPTION.

Consumption for 1904	2,007,628,297 Gallons.
Consumption for 1903	1,922,390,231 Gallons.
An increase in 1904 of.....	85,238,048 Gallons.

The maximum pumpage for any one day was on Wednesday, February 17, viz:—

At West Sixth Street station.....	6,573,750 Gallons.
At Cook Wells station ..	2,971,904 Gallons.
Total	9,545,654 Gallons.

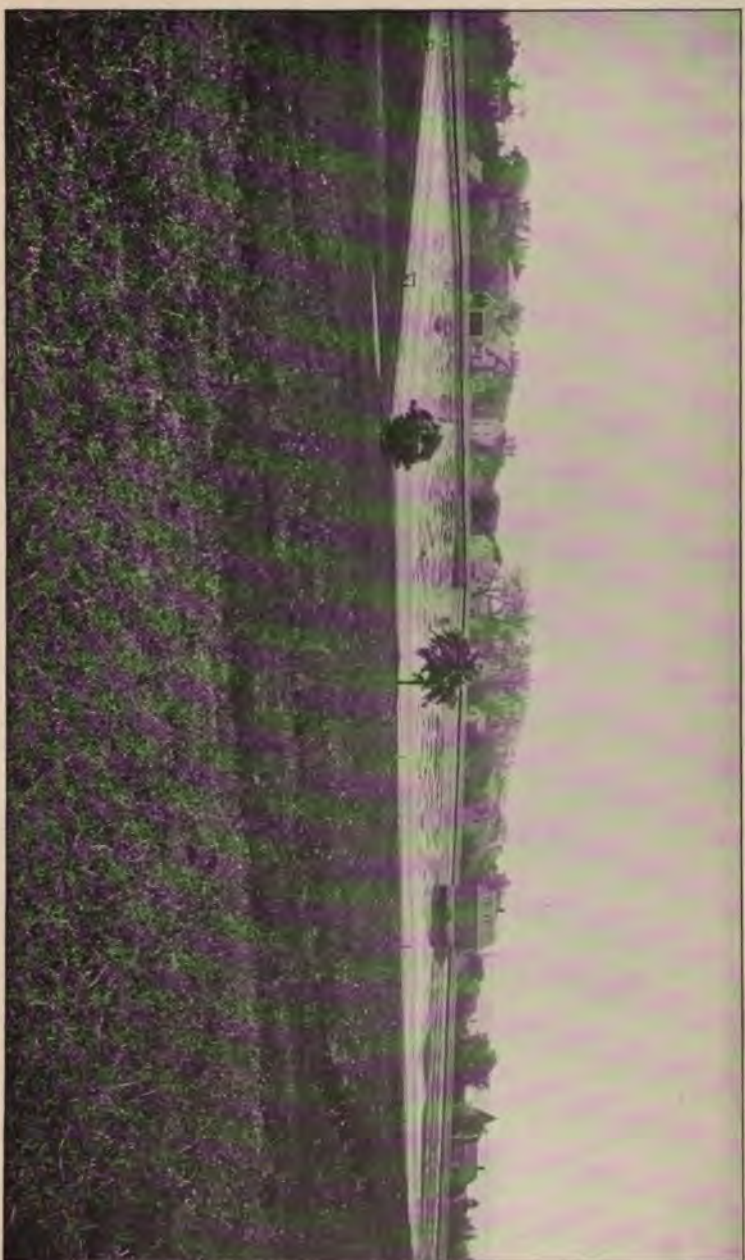
The maximum pumpage for any one week was on the week of February 16 — 22, viz :—

At West Sixth Street station	38,407,670 Gallons.
At Cook Wells station	20,579,424 Gallons.
Total	58,987,094 Gallons.

The pumpage for High Service was 68,174,988 gallons, which is 15,301,230 gallons more than last year.

The cost of Low Service pumpage is nineteen dollars and sixty-nine cents (\$19.69) per million gallons, a decrease of four dollars and thirty-four cents (\$4.34) per million gallons from that of last year.

The cost of High Service pumpage is eleven dollars and fifty-two cents (\$11.52) per million gallons, which added to the cost of Low Service pumpage (\$19.69), makes the total cost of pumpage into the High Service system, thirty-one dollars and twenty-one cents (\$31.21) per million gallons a decrease of nine dollars and ten cents (\$9.10) per million gallons from that of last year.



LOW SERVICE RESERVOIR — LOOKING SOUTHWEST.

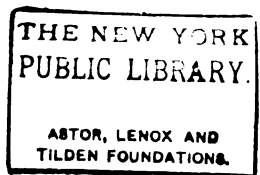


TABLE SHOWING QUANTITY PUMPED EACH MONTH AT THE SEVERAL STATIONS
DURING THE YEAR 1904.

Months	PUMPING STATIONS										Grand Totals	Net Totals
	Driven Wells					West Sixth Street						
	Cook Wells	Lower Boulevard	Upper Boulevard	Totals	Net Totals	Worthington High Duty	Worthington Duplex	Morris	Totals Low Service	High Service		
Jan. ....	.....	215,259,420	.....	215,259,420	.....	206,595,000	.....	.....	206,595,000	4,197,354	426,051,774	206,595,000
Feb.	39,787,328	178,073,321	.....	217,860,649	39,787,328	155,946,750	2,148,920	10,305,600	168,401,270	3,388,728	389,650,617	208,188,598
March....	7,383,104	173,488,145	.....	180,871,249	7,383,104	124,138,500	.....	41,809,600	165,948,100	2,742,908	349,562,257	173,331,204
April ..	.....	21,165,611	137,526,682	158,692,293	.....	.....	23,637,500	119,582,320	143,189,820	3,100,624	304,990,637	143,189,820
May .....	.....	.....	163,871,481	163,871,481	.....	8,628,250	.....	156,951,040	160,577,290	3,636,780	328,065,551	160,577,290
June .....	.....	2,270,888	159,921,873	162,192,261	.....	165,437,250	1,153,200	.....	166,590,450	3,012,114	331,794,825	166,590,450
July .....	.....	184,639,496	.....	184,639,496	.....	125,877,100	21,509,010	26,416,640	173,303,180	12,304,500	370,251,476	173,303,180
Aug.	16,777,280	151,026,231	.....	170,803,511	16,777,280	7,096,875	1,763,900	131,360,320	140,221,035	13,485,360	324,509,566	156,998,375
Sept. ....	.....	106,681,829	57,083,642	163,764,971	.....	96,098,125	51,342,200	17,733,760	164,174,085	11,847,480	339,796,486	164,174,085
Oct. ....	.....	.....	157,488,945	157,488,945	.....	44,052,750	21,187,570	90,013,120	155,253,440	4,437,300	317,179,635	155,253,440
Nov. ....	.....	.....	140,825,450	140,825,450	.....	.....	.....	136,861,440	136,861,440	2,864,131	250,552,024	136,861,440
Dec. ....	.....	122,885,295	57,946,859	180,832,154	.....	2,769,375	12,276,310	147,379,200	162,424,885	3,144,456	346,401,495	162,424,885
Totals..	63,947,712	1,158,489,736	874,664,382	2,097,101,830	63,947,712	930,138,375	135,019,640	878,383,040	1,943,540,065	68,174,988	4,106,816,873	2,007,467,767

TABLE SHOWING SOURCE OF SUPPLY, QUANTITY PUMPED AND COST OF PUMPING AT THE SEVERAL STATIONS DURING THE YEAR 1904.

PUMPING STATIONS	SOURCE OF SUPPLY—WELL WATER				COST	
	46 Driven Wells at Pawtucket Boulevard	210 Driven Wells in the Valley of River Meadow Brook	Distributing Mains of Low Service System	Totals in U. S. Gallons	Totals	Per Million Gallons
West Sixth Street Low Service	1,943,640,055	.....	.....	1,943,640,055	\$19,392.51	\$ 9.45—
High Service .....	.....	.....	68,174,988	68,174,988	725.19	11.50—
Cook Wells .....	.....	68,947,713	.....	68,947,713	1,332.00	20.49—
Lower Boulevard	1,158,499,796	.....	.....	1,158,499,796	13,782.73	11.90—
Upper Boulevard	874,664,362	.....	.....	874,664,362	6,112.56	6.99—
Total Pumpage .....	.....	.....	.....	4,165,315,273	949,205.99	29.21—
Deduct { at Lower Boulevard quantity at Upper Boulevard pumped } by High Service	1,158,499,796* 874,664,362*	.....	68,174,988	.....	.....	.....
Net Pumpage .....	.....	.....	.....	2,937,457,307	949,205.99	323.00—
Cost exclusive of High Service .....	.....	.....	.....	.....	.....	319.00—
Total cost of High Service pumpage .....	.....	.....	.....	.....	.....	\$31.21—

*Repumped at West Sixth Street.

The following tables, showing the performance of the engines, depth and quantity of water in the Beacon Street Reservoir, average temperature of the air and water at the Beacon Street Reservoir, and the average monthly and daily consumption of water, have been calculated and compiled from the records kept by the engineers and gate-keeper.

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH DUTY ENGINE, FOR
EACH MONTH DURING THE YEAR 1904.

MONTHS	No. of days pumping	Average No. of hours pumping per day	No. of hours pumping per month	No. of strokes made per month	Average No. of strokes per minute	Average head including friction, in feet	Quantity pumped in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gallons of water pumped into reservoir per lb. of total coal consumed	Duty in lbs. with 100 lbs. coal used in pump'g only; no deduction for ashes or clinkers	Duty on total coal consumed; no deduction for ashes or clinkers
January	31	24-00	744-00	550,920	12.34	164.44	200,595,000	6,664,355	616	84,987,039	84,415,135
February	27	22-21	603-30	415,898	11.48	164.77	155,946,750	5,775,806	583	82,882,494	80,017,407
March	23	23-13	534-00	331,096	10.35	164.70	124,138,500	5,397,326	593	81,410,453	81,410,453
April .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
May	1	17-00	17-00	9,670	9.48	164.83	3,626,250	3,626,250	646	88,736,039	88,736,039
June	30	23-40	710-00	411,166	10.36	164.75	166,457,250	5,514,575	627	87,617,327	86,125,706
July	23	22-01	566-30	334,340	11.00	164.75	125,377,500	5,451,166	610	84,209,750	83,715,327
August	3	10-00	30-00	18,925	10.51	164.10	7,096,875	2,365,625	439	67,607,641	60,071,222
September	22	15-48	413-30	253,595	10.22	163.92	95,098,135	4,322,642	454	62,437,301	62,009,429
October	10	18-24	184-00	117,474	10.64	164.26	44,052,750	4,405,275	438	60,838,492	59,900,558
November .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
December	2	5-15	10-30	7,385	11.72	164.43	2,769,375	1,384,687	444	60,847,197	60,847,197
Totals and Averages	172	21-49	3:53-00	2,480,369	11.02	164.54	930,138,375	5,407,751	574	80,209,796	78,760,764

TABLE SHOWING WORK DONE WITH WORTHINGTON DUPLEX ENGINE, FOR EACH MONTH DURING THE YEAR 1904.

MONTHS	No. of days pumping	Average No. of hours pumping per day	No. of hours pumping per month	No. of strokes made per month	Average No. of strokes made per minute	Average head including friction, in feet	Quantity pumped in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gallons of water pumped into reservoir per lb. total coal consumed	Duty in lbs. with 100 lbs. coal used in pump'g only, no deduction for ashes or clinkers	Duty on total coal consumed, no deduction for ashes or clinkers
January .....	....	....	....	....	....	....	....	....	....	....	....
February	1	10-30	10-30	6,832	11.00	162.72	2,148,920	2,148,920	398	53,945,099	53,940,099
March .....	....	....	....	....	....	....	....	....	....	....	....
April	6	19-30	117-00	76,250	10.86	103.32	23,637,600	3,939,583	877	51,344,871	51,344,871
May .....	....	....	....	....	....	....	....	....	....	....	....
June	1	6-00	5-00	3,720	12.40	162.22	1,153,200	1,153,200	367	40,598,386	40,598,386
July	6	17-45	106-30	69,384	10.86	161.90	21,509,040	3,584,840	395	52,067,890	52,067,890
August	1	8-00	8-00	5,690	11.85	161.52	1,703,900	1,703,900	350	47,111,109	47,111,109
September...	11	20-05	221-00	165,620	12.49	162.58	51,342,200	4,667,173	472	54,447,722	54,447,722
October	5	20-30	102-30	69,347	11.11	164.85	21,187,570	4,237,514	349	51,303,061	47,990,067
November ..	....	....	....	....	....	....	....	....	....	....	....
December ..	3	16-20	49-00	39,601	13.47	165.03	12,276,810	4,092,102	376	55,269,799	50,994,705
Totals and Averages..	34	18-13	619-30	435,544	11.72	163.10	135,018,640	3,971,136	392	53,216,420	51,889,796

TABLE SHOWING WORK DONE WITH MORRIS ENGINE (BEAM AND FLY WHEEL)
FOR EACH MONTH DURING THE YEAR 1904.

MONTHS	No. of days pumping	Average No. of hours pumping per day	No. of hours pumping per month	No. of strokes made per month	Average No. of strokes made per minute	Average head including friction, in feet	Quantity pumped per month in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gallons of water pumped into reservoir per lb. total coal consumed	Duty in lbs. a foot high coal used in pump's only, no deduction for ashes or clinkers	Duty on total coal consumed, no deduction for ashes or clinkers
January.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
February.....	3	18-10	54-30	32,205	9.85	164.80	10,305,600	3,435,200	490	70,021,532	67,305,281
March.....	10	21-00	210-00	130,635	10.37	162.30	41,860,600	4,186,060	506	68,377,156	68,377,156
April.....	26	22-47	592-30	373,001	10.51	162.40	119,552,320	4,598,166	558	77,124,088	75,469,368
May.....	31	23-27	727-00	480,472	11.24	162.43	150,361,040	5,002,037	615	83,231,760	83,231,760
June.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
July.....	6	21-20	128-00	82,552	10.75	163.16	26,416,640	4,402,773	565	80,275,678	76,773,228
August.....	27	22-51	617-00	410,501	11.09	162.97	131,360,230	4,863,197	594	82,019,202	80,611,093
September...	5	16-30	82-30	55,418	11.20	164.07	17,733,760	3,546,732	527	72,114,267	72,114,267
October.....	20	21-45	435-00	281,291	10.78	164.54	90,012,120	4,500,656	513	74,014,239	70,334,316
November...	30	23-36	708-00	427,092	10.07	164.75	136,861,440	4,562,048	484	68,488,143	66,403,662
December...	30	22-19	660-30	460,560	11.47	164.45	147,370,200	4,912,640	491	67,003,494	67,315,109
Totals and Averages..	188	22-28	4,224-00	2,744,947	10.83	163.52	878,383,040	4,672,250	538	74,098,741	73,282,686

TABLE SHOWING WORK DONE WITH WORTHINGTON HIGH SERVICE ENGINE FOR
EACH MONTH DURING THE YEAR 1904.

MONTHS	No. of days pumping	Average No. of hours pumping per day	No. of hours pumping per month	No of strokes made per month	Average No. of strokes made per minute	Average head, including friction, in feet	Quantity pumped per month in U. S. gallons	Average quantity pumped per day in U. S. gallons	No. gallons pumped into reservoir per 100 (total cost) consumed	Cost in lbs. used when pumping
January...	12	19-00	228-00	299,811	21.92	70.44	4,107,354	249,779	3600	13,961
February...	11	16-11	178-00	242,062	22.66	70.44	3,396,726	206,066	3600	11,900
March.....	9	16-33	149-00	196,922	21.92	70.44	2,712,896	301,706	3600	9,143
April.....	10	17-15	172-30	222,116	21.46	70.44	3,109,024	210,962	3600	10,966
May.....	10	17-06	171-00	259,770	26.32	70.44	3,036,760	253,076	3600	12,123
June.....	9	16-30	145-30	215,151	24.16	70.44	3,012,114	234,679	3600	10,060
July.....	30	23-39	709-30	879,200	20.65	93.59	12,209,960	410,299	3600	41,373
August.....	31	24-00	744-00	963,240	21.56	93.59	13,496,360	435,042	3600	44,961
September...	30	24-00	720-00	946,245	19.99	93.59	11,947,430	398,914	3600	39,491
October.....	12	19-12	230-30	316,960	22.92	90.10	4,337,260	360,776	3600	14,701
November...	8	18-22	145-30	204,561	23.20	70.44	2,964,134	266,017	3600	9,547
December....	10	17-15	172-30	224,604	21.70	70.44	3,141,406	214,446	3600	10,602
Totals and Averages..	182	20-43	8,770-30	4,999,642	21.53	92.64	66,174,596	274,598	3600	227,249

**TABLE SHOWING AMOUNT OF COAL USED FOR
WORTHINGTON HIGH DUTY ENGINE AT PUMP-
ING STATION DURING THE YEAR 1904.**

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January.....	2,265	333,141	.....	335,406
February	7,195	258,528	1,900	267,623
March.....	.....	209,302	.....	209,302
April.....	.....	.....	.....	.....
May.....	.....	5,614	.....	5,614
June	3,440	259,252	1,050	263,742
July.....	600	204,426	600	205,626
August	1,000	14,356	800	16,156
September	700	207,905	700	209,305
October.....	4,800	90,226	5,600	100,626
November .....	.....	.....	.....	.....
December.....	.....	6,237	.....	6,237
Totals	20,000	1,588,987	10,650	1,619,637

TABLE SHOWING AMOUNT OF COAL USED FOR
WORTHINGTON DUPLEX ENGINE AT PUMP-
ING STATION DURING THE YEAR 1904.

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January.....	.....	.....	.....	.....
February .....	.....	5,402	.....	5,402
March.....	.....	.....	.....	.....
April .....	.....	62,661	.....	62,661
May.....	.....	.....	.....	.....
June .....	.....	3,144	.....	3,144
July.....	.....	55,738	.....	55,738
August .....	.....	5,040	.....	5,040
September .....	.....	127,766	.....	127,766
October.....	4,385	54,609	1,800	60,794
November .....	.....	.....	.....	.....
December	1,300	30,549	1,300	33,149
Totals	5,685	344,909	3,100	353,694

**TABLE SHOWING AMOUNT OF COAL USED FOR
MORRIS ENGINE AT PUMPING STATION
DURING THE YEAR 1904.**

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January.....	.....	.....	.....	.....
February	400	20,214	400	21,014
March .....	.....	82,706	.....	82,706
April	2,300	209,801	2,300	214,401
May .....	.....	255,267	.....	255,267
June .....	.....	.....	.....	.....
July	2,040	44,745	.....	46,785
August .....	.....	217,525	3,800	221,325
September .....	.....	33,625	.....	33,625
October.....	7,125	166,769	1,600	175,494
November	4,200	274,375	4,200	282,775
December	1,300	297,462	1,300	300,062
Totals	17,365	1,602,489	13,600	1,633,454

TABLE SHOWING AMOUNT OF COAL USED FOR
DEANE ENGINES AT PUMPING STATION,
COOK WELLS, DURING THE YEAR 1904.

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January
February	182,855	.....	182,855
March	31,540	.....	31,540
April
May
June
July
August	78,139	.....	78,139
September
October
November
December
Totals	292,534	.....	292,534

**TABLE SHOWING AMOUNT OF COAL USED FOR
KNOWLES ENGINES AT PUMPING STATION,
LOWER BOULEVARD, DURING
THE YEAR 1904.**

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January.....	565,055	.....	565,055
February	471,750	.....	471,750
March.....	434,600	.....	434,600
April.....	40,380	.....	40,380
May.....	15,395	15,395
June	8,000	.....	8,000
July.....	396,350	.....	396,350
August	301,263	.....	301,263
September	216,363	.....	216,363
October
November
December.....	256,285	.....	256,285
Totals	2,690,046	15,395	2,705,441

TABLE SHOWING AMOUNT OF COAL USED FOR
 WORTHINGTON ENGINES AT PUMPING STATION,
 UPPER BOULEVARD, DURING
 THE YEAR 1904.

MONTHS	COAL CONSUMED			
	For Starting Fires, In Pounds	When Pumping, In Pounds	For Banking Fires, In Pounds	Total Per Month, In Pounds
January.....
February
March.....
April.....	260,300	.....	260,300
May.....	308,715	.....	308,715
June	286,140	.....	286,140
July.....
August
September	104,438	.....	104,438
October.....	268,835	.....	268,835
November	242,700	.....	242,700
December	83,800	.....	83,800
Totals	1,554,928	.....	1,554,928

**WEST SIXTH STREET PUMPING STATION, WORTH-
INGTON HIGH DUTY ENGINE, RUNNING
EXPENSES FOR THE YEAR 1904.**

Pay of Engineers and Firemen.....	\$4,173.55
206 1958-2000 tons of coal (Cumberland 1903) at \$5.084+	1,052.34
125 914-2000 tons of coal (Sonman Cumb. 1904) at \$5.125.....	642.97
26 729-2000 tons of coal (New River Cumb. 1904) at \$4.196+	110.64
451 36-2000 tons of coal (New River Cumb. 1904) at \$4.062+	1,832.27
312 11-100 gallons of cylinder oil, at \$0.526+	164.29
129 72-100 gallons of engine oil, at \$0.341—	44.21
123 71-100 pounds of packing, at \$0.906—	112.07
221 3-100 pounds of cotton waste, at \$0.125—	27.54
336 50-100 pounds of castorine and keystone grease, at \$0.138+	46.44
54 pounds of tallow, at \$0.06	3.24
Repairs on engines	199.47
Repairs on boilers	147.10
Tools and stock	11.17
Sundries.....	60.79
Total.....	\$8,628.09

Cost of pumping water into reservoir per million gallons, \$9.28—.

Cost of pumping water one foot high per million gallons, \$0.05 64-100.

WEST SIXTH STREET PUMPING STATION, WORTH-
INGTON DUPLEX ENGINE, RUNNING
EXPENSES FOR THE YEAR 1904.

Pay of Engineers and Firemen.....	\$635.11
11 1998-2000 tons of coal (Cumb. 1903) at \$5.684+	61.01
25 1470-2000 tons of coal (Sonman Cumb. 1904) at \$5.125.....	131.89
139 226-2000 tons of coal (New River Cumb. 1904) at \$4.062+	565.15
47 50-100 gallons of cylinder oil, at \$0.526+	25.00
19 74-100 gallons of engine oil, at \$0.341—	6.73
13 3-10 pounds of packing, at \$0.576.....	7.66
33 63-100 pounds of cotton waste, at \$0.125—	4.19
15 pounds of tallow, at \$0.06.....	.90
Repairs on boilers.....	22.38
Tools and stock.....	1.70
Sundries	9.25
 Total	 \$1,470.97

Cost of pumping water into reservoir per million gallons, \$10.89+.

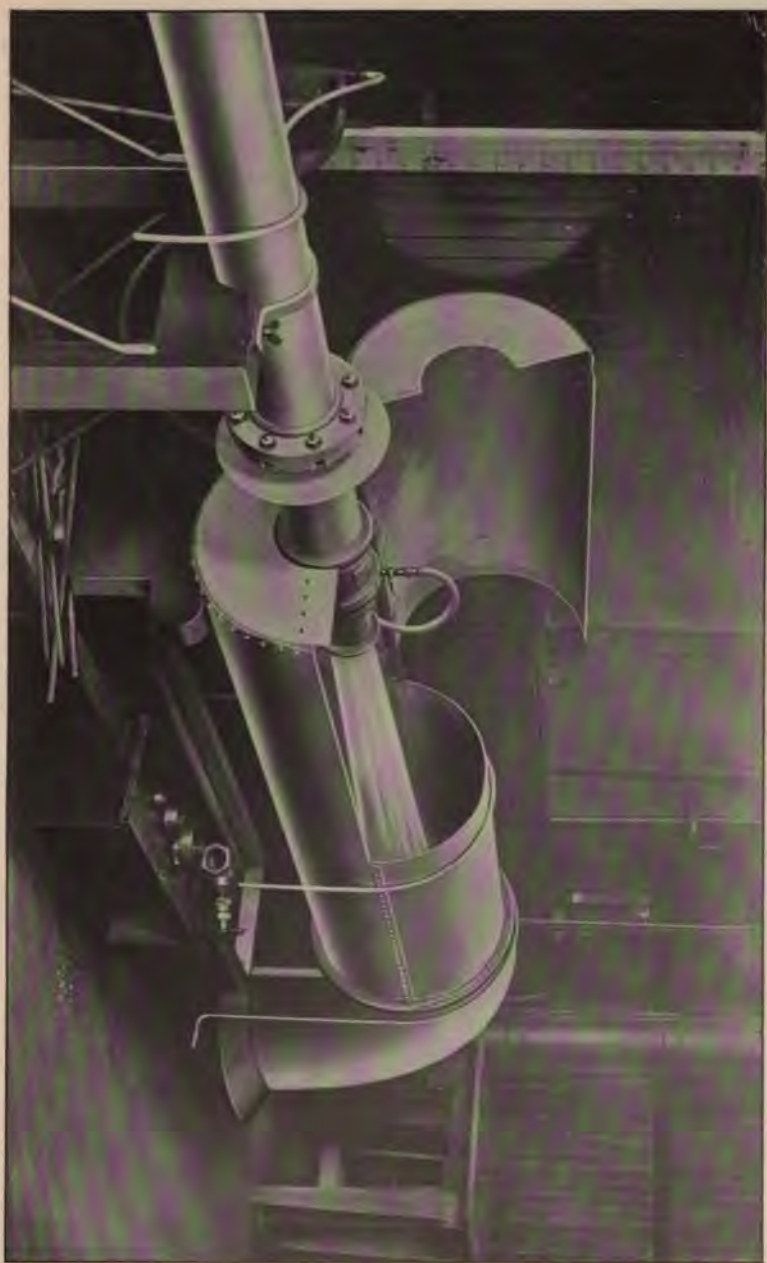
Cost of pumping water one foot high per millian gallons, \$0.06 68-100—.

**WEST SIXTH STREET PUMPING STATION, MORRIS
ENGINE, RUNNING EXPENSES FOR
THE YEAR 1904.**

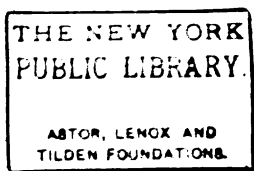
Pay of Engineers and Firemen.....	\$3,992.05
74 1,785 2000 tons of coal Cumb. 1903, at \$5.084+	381.28
164 119-2000 tons of coal (Monman Cumb. 1904) at \$5.125	890.80
127 1267 2000 tons of coal (New River Cumb. 1904) at \$4.196+ ..	535.60
450 83 2000 tons of coal (New River Cumb. 1904) at \$4.062+	1,828.29
298 54-100 gallons of cylinder oil, at \$0.526+	157.15
124 8-100 gallons of engine oil, at \$0.341—	42.29
46 26 100 pounds of packing, at \$0.597+	27.64
211 42 100 pounds of cotton waste, at \$0.125—	26.34
27 pounds of tallow, at \$0.06	1.62
Repairs on engine.....	160.12
Repairs on boiler	140.70
Tools and stock	10.68
Landre	58.15
Total	\$8,202.75

Cost of pumping water into reservoir per million gallons, \$9.34—.

Cost of pumping water one foot high per million gallons, \$0.05 71-100+.



4-INCH NOZZLE DISCHARGING 2,600 GALLONS PER MINUTE.



WEST SIXTH STREET PUMPING STATION, HIGH
SERVICE ENGINE, RUNNING EXPENSES
FOR THE YEAR 1904.

Pay of Engineers and Firemen.....	\$272.10
5 1999-2000 tons of coal (Cumb. 1903), at \$5.084+	30.50
6 867-2000 tons of coal (Sonman Cumb. 1904), at \$5.125	32.97
6 123-2000 tons of coal (New River Cumb. 1904), at \$4.196+	25.43
95 260-2000 tons of coal (New River Cumb. 1904), at \$4.062+	386.47
20 35-100 gallons of cylinder oil, at \$0.526+	10.71
8 46-100 gallons of engine oil, at \$0.341—	2.89
8 42-100 pounds of packing, at \$0.652+	5.49
14 42-100 pounds of cotton waste, at \$0.125—	1.80
Repairs on engine.....	2.37
Repairs on boilers.....	9.59
Tools and stock.....	.73
Sundries	3.96
Total	\$785.10

Cost of pumping water into reservoir per million gallons, \$11.52—.

Cost of pumping water one foot high per million gallons, .13 93-100+.

**COOK WELLS PUMPING STATION, DEANE ENGINES,
RUNNING EXPENSES FOR THE
YEAR 1904.**

Pay of Engineers and Firemen.....	\$323.80
146 534-2000 tons of coal (Sonman Camb. 1903), at \$5.125	749.62
50 gallons of kerosene oil for lighting works, at \$0.11	5.50
49 gallons of cylinder oil, at \$0.44	21.56
5 gallons of engine oil, at \$0.35	1.75
47 5-10 pounds of packing, at \$0.348+	16.55
25 pounds of cotton waste, at \$0.125—	3.12
Repairs on engines	36.90
Repairs on boilers.....	82.35
Tools and stock.....	41.83
Sundries	40.02
Total	\$1,323.00

Cost of pumping water into distributing mains per million gallons, \$20.69—.

LOWER BOULEVARD PUMPING STATION, KNOWLES
ENGINES, RUNNING EXPENSES FOR
THE YEAR 1904.

Pay of Engineers and Firemen.....	\$4,564.00
755 1785-2000 tons of coal (Cumb. 1903), at \$7.646	5,779.55
589 261-2000 tons of coal (New River Cumb. 1904), at \$4.241+	2,498.54
400 gallons of kerosene oil for lighting works, at \$0.114—	45.50
139 gallons of cylinder oil, at \$0.456+	63.43
25 5-10 gallons of engine oil, at \$0.35	8.92
36 56-100 pounds of packing, at \$0.753+	27.53
178 pounds of cotton waste, at \$0.122—	21.65
Repairs on engines.....	152.11
Repairs on boilers	489.76
Tools and stock.....	44.41
Sundries	88.32
 Total	 \$13,783.72

Cost of pumping water into conduit per million gallons, \$11.90—.

**UPPER BOULEVARD PUMPING STATION, WORTH-
INGTON ENGINES, RUNNING EXPENSES
FOR THE YEAR 1904.**

Pay for Engineers and Firemen.....	\$2,390.46
284 1015-2000 tons of coal (Cumb., 1903), at \$5.105	1,452.41
492 1913-2000 tons of coal (New River Cumb. 1904), at \$4.241+ ...	2,090.66
200 gallons of kerosene oil for lighting works, at \$0.11.....	22.00
100 gallons of cylinder oil, at \$0.44	44.00
25 5-10 gallons of engine oil, at \$0.35.....	8.93
24 pounds of packing, at \$0.50.....	12.00
100 pounds of cotton waste, at \$0.125.....	12.50
Repairs on engines.....	66.30
Sundries	13.00
Total	\$6,112.26

Cost of pumping water into conduit per million gallons, \$6.99—.

RESERVOIR, BEACON STREET, 1904.

MONTHS	Depth in Feet	Quantity in U. S. Gallons	Temperature in Degrees	
			Of Water	Of Air
January	16.23	26,214,777	44.42	20.24
February	16.12	26,073,804	40.28	20.31
March	16.88	30,314,657	30.16	35.02
April	18.96	28,820,370	38.33	43.64
May	16.77	30,133,314	40.13	61.33
June	16.52	26,741,010	46.87	65.21
July	20.02	30,544,123	46.61	72.15
August	16.17	26,126,875	56.61	68.73
September	16.33	26,304,013	50.23	61.11
October	20.13	30,740,108	50.44	48.72
November	20.06	30,623,047	54.50	36.17
December	16.12	26,043,220	50.07	24.50

**TABLE SHOWING THE AVERAGE MONTHLY AND
DAILY CONSUMPTION OF WATER FOR
THE YEAR 1904.**

MONTHS	Gallons per Month	Gallons per Day
January	206,313,551	6,655,276
February	208,470,047	7,188,622
March	172,202,080	5,554,904
April	143,755,543	4,791,851
May	161,841,904	5,220,707
June	166,869,926	5,562,331
July	172,883,755	5,576,895
August	159,220,706	5,136,152
September	162,510,706	5,417,024
October	153,145,743	4,940,185
November	137,426,597	4,580,887
December	162,987,781	5,257,670
Totals and Averages	2,007,628,279	5,485,323

The following table shows the average daily consumption of water, in gallons, for each month and each year since the installation of the system.

**AVERAGE DAILY CONSUMPTION OF WATER, IN GALLONS, FOR EACH MONTH AND
YEAR FROM JANUARY, 1873, TO DECEMBER, 1904; INCLUSIVE.**

YEARS	MONTHS												For the Year
	January	February	March	April	May	June	July	August	September	October	November	December	
1873	808,777	373,437	527,321	856,148	430,301	569,770	826,215	598,634	571,021	531,022	480,646	591,202	511,462
1874	633,810	667,770	638,846	609,470	708,760	919,830	977,300	850,820	850,880	700,660	750,660	890,220	780,208
1875	1,211,480	1,377,880	1,092,070	920,810	1,061,770	1,314,750	1,359,660	1,260,070	1,238,470	1,117,250	1,130,290	1,540,540	1,222,300
1876	1,484,980	1,527,830	1,325,780	1,073,002	1,275,180	1,354,764	1,351,640	1,062,020	1,030,226	1,348,380	1,193,376	1,805,810	1,484,862
1877	1,983,090	1,616,882	1,445,180	1,291,636	1,453,870	1,780,113	1,767,740	1,768,760	1,606,075	1,601,890	1,406,773	1,660,420	1,631,360
1878	2,038,960	1,894,890	1,683,690	1,297,310	1,834,140	1,760,380	2,262,500	1,813,970	1,908,056	1,643,400	1,615,424	1,804,850	1,784,860
1879	2,407,960	2,241,030	1,921,940	1,716,990	2,020,250	1,991,590	2,262,500	2,090,340	1,908,056	1,560,330	1,756,000	2,178,000	2,023,200
1880	1,977,760	2,144,060	1,933,610	1,839,800	2,223,670	2,486,780	2,438,080	2,492,330	2,408,940	2,208,430	2,229,350	2,574,000	2,252,197
1881	3,151,280	3,054,550	2,945,410	2,222,330	2,223,590	2,281,370	2,383,280	2,472,830	2,360,290	2,205,760	2,082,790	2,168,830	2,309,168
1882	2,883,560	2,909,540	2,963,290	2,163,990	2,303,680	2,774,250	3,220,640	3,220,680	2,631,690	2,404,430	2,211,800	2,622,015	2,622,015
1883	3,341,650	3,068,900	3,893,390	2,436,000	2,730,670	2,907,920	3,988,780	3,220,780	2,910,440	2,408,160	2,374,830	3,063,220	2,862,710
1884	3,600,160	3,032,120	3,025,910	2,513,700	2,620,820	3,127,350	3,188,430	3,166,100	3,111,010	2,806,130	2,645,010	3,334,160	3,016,040
1885	4,137,730	4,924,960	3,907,290	3,103,360	2,996,000	3,903,860	3,545,920	3,303,190	3,242,620	3,067,880	3,125,447	3,947,020	3,667,520
1886	4,527,610	4,927,900	4,213,570	3,490,560	3,416,380	4,300,546	4,522,064	3,922,610	3,903,650	3,440,450	3,015,680	4,409,650	3,957,660
1887	5,470,250	4,762,659	4,276,024	3,707,866	4,222,327	4,300,546	4,522,064	4,320,440	4,300,049	3,894,148	3,672,886	4,480,818	4,310,164
1888	6,011,570	6,707,935	5,305,426	4,213,817	4,241,166	4,738,913	4,919,008	4,646,288	4,367,616	4,378,838	4,512,348	6,181,297	4,981,118
1889	4,889,917	5,495,132	4,344,194	4,139,769	4,516,328	4,738,913	4,919,008	4,769,079	4,668,705	4,349,478	4,366,827	4,660,262	4,333,165
1890	5,034,419	5,317,487	5,037,524	4,697,240	4,692,172	5,234,913	5,101,724	5,383,386	5,671,550	5,380,569	5,674,790	6,674,267	5,373,386
1891	6,346,281	6,040,030	5,068,225	5,292,180	5,830,909	6,076,131	6,181,190	5,833,386	6,170,678	5,747,064	5,661,719	5,899,063	5,619,092
1892	5,911,254	6,040,450	5,068,591	5,340,879	5,340,879	6,076,131	6,181,190	6,460,261	6,386,374	5,290,259	5,613,792	5,823,098	5,074,363
1893	5,639,870	5,885,586	5,098,144	5,646,919	5,910,870	6,330,711	6,746,530	6,746,621	6,194,731	5,415,510	5,990,033	7,325,656	6,816,913
1894	7,285,744	7,817,660	6,986,717	6,014,810	6,154,297	6,330,711	7,104,453	6,571,093	6,190,377	5,831,300	5,900,033	6,560,504	6,066,170
1895	7,397,435	7,938,693	6,645,162	6,034,913	6,492,212	7,033,373	7,032,587	7,343,446	7,197,896	6,674,267	6,340,076	7,110,614	6,922,092
1896	7,422,486	7,660,367	6,498,264	6,187,608	6,401,683	6,296,703	6,856,239	6,303,968	6,348,176	6,301,085	6,430,077	6,898,918	6,694,364
1897	7,769,816	7,214,765	6,232,698	6,202,828	6,386,118	6,612,043	6,743,828	6,070,647	6,743,119	6,300,619	6,128,090	6,966,346	6,734,604
1898	7,417,119	8,114,246	6,584,943	6,584,943	6,584,943	8,068,104	8,064,229	7,186,128	7,002,017	7,037,015	6,737,932	7,898,218	7,260,260
1899	7,511,763	8,127,419	6,024,115	7,065,858	7,784,931	8,037,963	8,066,114	8,268,526	8,138,836	7,386,297	7,292,997	7,844,543	7,893,356
1900	8,266,401	9,056,112	6,580,172	6,914,082	6,580,172	7,083,342	7,293,332	6,766,772	6,614,532	6,153,288	6,197,726	7,039,681	6,729,825
1901	6,170,916	6,114,904	5,651,749	6,446,046	6,707,401	6,217,117	6,083,104	5,963,912	5,461,532	5,107,818	4,771,831	5,969,016	5,729,825
1902	6,170,916	6,084,616	5,115,196	5,147,423	5,081,632	6,217,117	6,083,104	5,963,912	5,461,532	5,107,818	4,771,831	5,969,016	5,729,825
1903	6,170,916	6,084,616	5,115,196	5,147,423	5,081,632	6,217,117	6,083,104	5,963,912	5,461,532	5,107,818	4,771,831	5,969,016	5,729,825
1904	6,655,276	7,188,622	5,659,304	4,791,851	6,220,707	5,662,331	5,676,896	5,186,162	5,417,024	4,946,185	4,680,887	6,297,670	5,480,323

SUMMARY OF STATISTICS.

FOR THE YEAR ENDING DECEMBER 31, 1904.

In form recommended by the New England Water Works
Association.

— — — — —

LOWELL WATER WORKS.

LOWELL, MIDDLESEX COUNTY, MASSACHUSETTS.

GENERAL STATISTICS.

Population by census of 1900, 94,969.

Date of construction, 1870, to 1873.

Date of construction, High Service, 1881.

Date of construction, Driven wells, 1893 to 1903.

By whom owned : The City of Lowell.

Source of supply : Two hundred ten (210) driven wells in the
valley of River Meadow Brook, and three hundred forty-five
(345) driven wells at Pawtucket Boulevard.

Mode of supply : Pumping to reservoir and pumping direct.

PUMPING STATISTICS.

I. Builders of Pumping Machinery.

AT WEST SIXTH STREET STATION.

One engine, capacity 5,000,000 gallons in 24 hours, Henry
G. Morris.

One engine, capacity 5,000,000 gallons in 24 hours, Henry
R. Worthington.

One engine, capacity 10,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 500,000 gallons in 24 hours, Henry R. Worthington.

AT COOK WELLS STATION, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, The Deane Steam Pump Co.

One engine, capacity 3,000,000 gallons in 24 hours, The Deane Steam Pump Co.

AT LOWER BOULEVARD STATION, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

One engine, capacity 3,000,000 gallons in 24 hours, Knowles Steam Pump Works.

AT UPPER BOULEVARD STATION, TEMPORARY PUMPS.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

One engine, capacity 3,000,000 gallons in 24 hours, Henry R. Worthington.

2. Description of fuel used:

{	<ol style="list-style-type: none"> a. Kind, bituminous. b. Brand of coal,—Sonman and New River. c. Average price of coal per gross ton, delivered, \$4.75+ d. Percentage of ash. e. Wood, price per cord.
---	--
3. Coal consumed for the year, 8,386,937 pounds.
(Low Service, West Sixth Street Station, 3,606,785 pounds).
4. (Pounds of wood) ÷ 3 = equivalent amount of coal = 2,400, West Sixth Street Station.

5. Total equivalent coal consumed for the year = (3) + (4),
8,389,337 pounds. (Low Service, West Sixth Street
Station, 3,609,185 pounds).
6. Total pumpage for the year, 2,007,487,767 gallons.
7. Average static head against which pumps work, 156.30 feet,
West Sixth Street Station.
8. Average dynamic head against which pumps work, 163.97
feet, West Sixth Street Station.
9. Number of gallons pumped per pound of equivalent coal (5),
239. (Low Service, West Sixth Street Station, 538).
10. Duty =
$$\frac{\text{Gals. pumped (6)} \times 8.34 (\text{lbs.}) \times 100 \times \text{dynamic head (8)}}{\text{Total fuel consumed (5)}}$$

= 73,640,173. West Sixth Street Station, Low Service.
Cost of pumping figured on pumping station expenses,
viz: \$39,520.79.
11. Per million gallons pumped, \$19.69 — Low Service.
12. Per million gallons raised one foot (dynamic), \$0.1201 — Low
Service.

FINANCIAL STATISTICS.

RECEIPTS

Balance brought forward :

(a) From ordinary (maintenance)
receipts \$3,059.92
Total \$3,059.92

From Water Rates

A. Fixture rates 36,153.69
B. Meter rates 138,121.52
C. Total from consumers 174,275.21
F. For street watering 1,200.00
G. For Public buildings 5,500.00
J. Total from municipal dep'ts 6,700.00
K. From tax levy 17,800.00
M. From other sources 16,098.43

N. Total..... \$217,933.56

EXPENDITURES

Water Works Maintenance

A A. Operation (management
and repairs) \$ 88,357.69
C C. Total maintenance..... \$88,357.69
D D. Interest on bonds..... 45,631.00
(C C + D D) 133,988.69
E E. Payment of bonds..... 21,600.00
F F. Sinking fund 17,800.00

Water Works Construction

G G. Extension of mains..... 8,843.67
H H. Extension of services..... 4,899.13
J J. Special 2,328.79
K K. Total construction..... 16,071.59
L L. Unclassified expenses,.... 9,637.96
M M. Balance 18,835.32
(a a) Ordinary 18,835.32
Total balance..... 18,835.32

N. Total..... \$217,933.56

Disposition of balance — Carried to account of 1905.

O. Net cost of works to date..... \$2,996,402.05
P. Bonded debt at date 1,073,000.00
Q. Value of Sinking fund at date..... 406,430.22
R. Average rate of interest, four per cent.

STATISTICS OF CONSUMPTION OF WATER.

1. Estimated total population at date, — 104,400.
2. Estimated population on lines of pipe. (Estimated total population used).
3. Estimated population supplied. (Estimated total population used).
4. Total consumption for the year, — 2,007,628,279 gallons.
5. Passed through meters, — 875,780,355 gallons.
6. Percentage of consumption metered, — 43 62-100.
7. Average daily consumption, — 5,485,323 gallons.
8. Gallons per day to each inhabitant, — 52 5-10.
9. Gallons per day to each consumer, — 52 5-10 nearly.
10. Gallons per day to each tap, — 486.
11. Cost of supplying water, per million gallons, figured on total maintenance (item C. C.) \$44.01.
12. Total cost of supplying water, per million gallons, figured on total maintenance + interest on bonds, — \$66.74.

STATISTICS RELATING TO DISTRIBUTION SYSTEM.

MAINS.

1. Kind of pipe, cast iron.
2. Sizes, from 4 inch to 30 inch.
3. Extended 5706 feet during year.
5. Total now in use, — 133,67 miles.
8. Length of pipes less than 4 inches diameter — 2 miles, more or less.
9. Number of hydrants added during the year (public and private) 11.
10. Number of hydrants (public and private) now in use, — 1212.
11. Number of stop gates added during the year, — 26.
12. Number of stop gates now in use, — 1331.
13. Number of stop gates smaller than 4 inch, — 25.
14. Number of blow-offs, — 34.
15. Range of pressure on mains, 17 lbs. to 72 lbs. Low Service.

SERVICES.

16. Kind of pipe, Lead, Lead-lined iron, Iron and Tin-lined iron.
17. Sizes, $\frac{5}{8}$ " to 2".
18. Extended, 6,638 feet.

20. Total now in use, — 84.4 miles.
21. Number of service traps added during the year, — 178.
22. Number now in use, — 11,287.
23. Average length of Service, — 39.48 feet.
24. Average cost of service for the year, — \$27.52.
25. Number of meters added, — 277.
26. Number now in use, — 7,513.
27. Percentage of services metered, — 63.5.
28. Percentage of receipts from metered water ($B \div C$), 79.

The State Board of Health has made analyses of water each month from the Merrimack River (for record only), and wells at Pawtucket Boulevard; a record of which is annexed.

On August 24, 1903, your Board voted to refer to the City Engineer and Superintendent of Water Works the whole matter relative to supplying the Locks and Canals Company with water for fire purposes in such a manner as to prevent a repetition of the disaster of July 18, 1903, when the city water was polluted by River water being pumped into the city mains.

After consulting with the Engineer of the Locks and Canals Company, it was decided to remove all the connections between the pipes of their system and that of the City of Lowell, and then to allow them to use river water.

On May 13, 1904, an agreement was signed by the Mayor allowing them to substitute a 24 inch pipe for a 12 inch pipe, leading from their reservoir on Lynde's Hill through Fairmount, Mansur, Nesmith and East Merrimack Streets, across Concord River, to their pipe in Merrimack Square. This agreement provides "That the pipe shall be laid in a line and at grade approved by the City Engineer and in a manner satisfactory to him."

This has been done and your Board may congratulate itself on the successful solution of a problem, which has made possible the permanent removal of these dangerous connections.

In conclusion, I wish to thank you for your earnest co-operation and for the many courtesies I have received from you during the past year.

Respectfully submitted,

GEORGE BOWERS,

City Engineer.

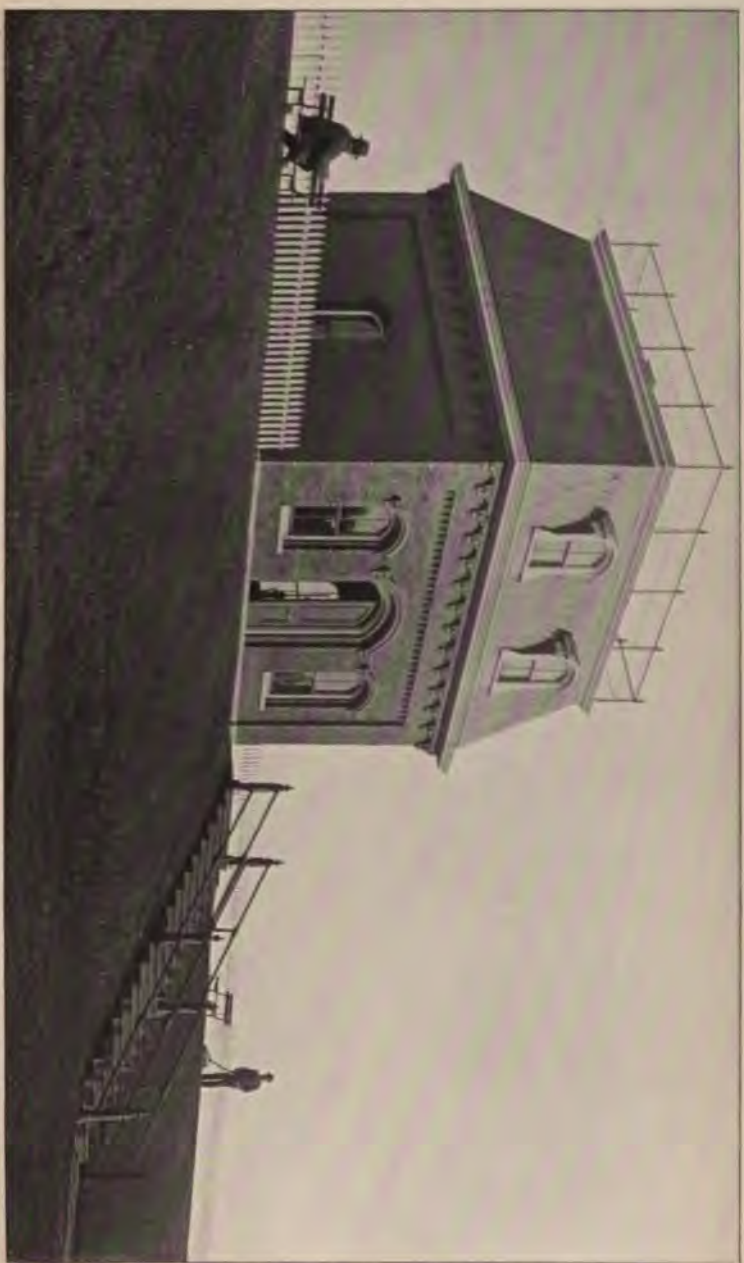
COMMONWEALTH OF MASSACHUSETTS. — STATE BOARD OF HEALTH.
LOWELL WATER ANALYSIS. — Merrimack River, Above Dam. (Parts in 100,000.)

No.	Date of Collection	Appearance			Odor		Residue on Evaporation		Ammonia				Chlorine	Nitrogenas		Hardness	Iron	Oxygen Consumed	
		Turbidity	Sedi- ment	Color	Cold	Hot	Total	Loss on Ignition	Fixed	Free	Albuminoid								
											Total	In Solu- tion	In Sus- pension						
48,699	Jan., 1904 25	slight	v. slight	.26	faintly unpleasant	faintly unpleasant	4.75	1.90	2.85	.0102	.0186	.0156	.0080	.28	.0060	.0002	1.3	....	.67
48,903	Feb. 21	slight	cons.	.23	faintly unpleasant	dist unpleas't tarry	4.65	1.75	2.90	.0132	.0160	.0140	.0020	.31	.0060	.0002	1.7	....	.69
49,084	March 28	decided	cons., earthy	.35	faintly unpleasant	faintly unpleasant	2.55	1.15	1.40	.0020	.0276	.0136	.0110	.10	.0010	.0000	0.6	....	.51
49,289	April 25	slight	cons.	.26	faintly vegetable	distinctly vegetable	2.95	1.35	1.60	.0008	.0144	.0120	.0024	.14	.0010	.0001	0.8	....	.45
49,509	June 2	decided	cons.	.35	faintly vegetable	faintly vegetable	3.30	1.65	1.65	.0048	.0158	.0122	.0036	.16	.0120	.0001	1.0	....	.50
49,865	June 28	slight	cons.	.24	faintly veg. & unpleasant	faintly veg. & unpleasant	6.30	2.10	4.20	.0062	.0208	.0156	.0062	.25	.0040	.0003	1.7	....	.51
50,371	July 26	v. slight	slight	.23	v. faintly vegetable	faintly vegetable	4.20	1.70	2.50	.0110	.0166	.0134	.0032	.29	.0060	.0002	1.4	....	.36
	Aug.																		
51,411	Sept. 27	slight	cons.	.34	faintly veg. and musty	distinctly veg. and musty	4.10	1.96	2.15	.0108	.0188	.0164	.0024	.23	.0070	.0002	1.1	...	.72
51,882	Oct. 26	decided	cons.	.66	distinctly unpleasant	distinctly unpleasant	4.85	2.35	2.50	.0060	.0244	.0188	.0066	.22	.0050	.0001	1.4	....	1.12
52,282	Nov. 29	v. slight	v. slight	.25	faintly vegetable	faintly veg. & unpleasant	4.25	1.65	2.60	.0068	.0188	.0128	.0060	.22	.0030	.0002	1.3	....	.74
52,519	Dec. 19	decided	v. slight	.21	faintly unpleas't; tarry	distinctly unpleas't; tarry	5.15	2.00	3.15	.0096	.0208	.0162	.0046	.29	.0060	.0002	1.4	....	.78

COMMONWEALTH OF MASSACHUSETTS.—STATE BOARD OF HEALTH.
LOWELL WATER ANALYSIS.—Boulevard Wells. (Parts in 100,000.)

No.	Date of Sampling	Appearance			Odor		Residue on Evaporation		Ammonia			Nitrogen as			Hardness	Iron	Oxygen Consumed		
		Turbidity	Color	Specific Heat	Cold	Hot	Total	Loss on Ignition	Fixed	Free	Total	In Solution	In Suspension	Chlorine				Nitrates	Nitrites
48,700	Jan. 23-25	v. slight	cons.	.005	none	none	3.80	....	....	.0070	.0032	....	....	.28	.0220	.0001	1.6	.0310	.07*
48,704	Feb. 24-25	v. slight	v. slight	.005	none	none	5.00	....	....	.0056	.0038	....	....	.27	.0200	.0001	2.6	.0520	.11*
49,055	March 28-29	v. slight	slight	.004	none	none	4.30	....	....	.0010	.0022	....	....	.32	.0100	.0002	2.3	.0650	.01*
49,259	April 25-26	none	none	.00	none	none	4.70	....	....	.0004	.0022	....	....	.29	.0240	.0000	2.6	.0080	†
49,570	June 1-2	v. slight	none	.00	none	none	3.80	....	....	.0004	.0022	....	....	.19	.0020	.0000	1.1	.0380	.04†
49,806	June 28-29	none	none	.00	none	none	3.90	....	....	.0004	.0028	....	....	.20	.0170	.0003	1.0	.0040	.06†
50,372	July 26-27	slight	slight	.010	none	none	4.00	....	....	.0052	.0034	....	....	.22	.0070	.0002	1.3	.0540	.18*
50,929	Aug. 27-29	v. slight	slight	.010	none	none	3.90	....	....	.0052	.0032	....	....	.28	.0060	.0002	1.4	.0700	.11*
51,412	Sept. 27-28	none	iron v. slight	.02	none	none	3.90	....	....	.0000	.0030	....	....	.27	.0090	.0000	1.4	.0040	.07*
51,883	Oct. 26-27	none	v. slight	.00	none	none	3.60	....	....	.0003	.0045	....	....	.24	.0070	.0000	1.7	.0030	.08†
52,284	Nov. 29-30	none	none	.00	none	none	4.00	....	....	.0010	.0036	....	....	.26	.0130	.0000	1.7	.0020	.08†
52,520	Dec. 19-20	v. slight	slight iron	.05	none	none	1.20	....	....	.0100	.0030	....	....	.25	.0050	.0000	1.7	.1000	.12*

* Over Boulevard. † Upper Boulevard.



GATE HOUSE LOW SERVICE RESERVOIR.

THE NEW YORK
PUBLIC LIBRARY
ASTOR LENOX AND
TILDEN FOUNDATIONS





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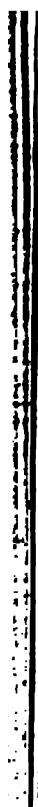
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